# REPORT RESUMES

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COMMUNICATION PROBLEMS AND THEIR EFFECT ON THE LEARNING POTENTIAL OF THE MENTALLY RETARDED CHILD.

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AN INVESTIGATION OF THE RELATIONSHIP BETWEEN COMPETENCE IN COMMUNICATION AND LEARNING POTENTIAL OF APPROXIMATELY 500 MENTALLY RETARDED CHILDREN, AGES 3 TO 9, WAS CONDUCTED. CONCERN WITH CARELESS DESIGNATION OF MENTAL RETARDATION AS A CAUSE OF DELAYED SPEECH LED TO A STUDY OF 1,200 CASE HISTORIES. MANY OF THESE CASE HISTORIES WERE DIAGNOSED CORRECTLY. HOWEVER, CAUSES WERE OBSCURE FOR NEARLY 30 PERCENT, CREATING DANGER OF FALSE DIAGNOSIS OF MENTAL RETARDATION. A FACTOR ANALYSIS OF 100 HISTORY AND TEST ITEMS ADMINISTERED BY A DIAGNOSTIC TEAM ADDED UNIFORMITY TO THE STUDY. THROUGH EXTENSIVE ANALYSIS EACH CHILD WAS CLASSIFIED IN ONE OF SIX CATEGORIES--LANGUAGE DISORDERS, EMOTIONAL DISTURBANCES, MENTAL RETARDATION, LESSER PROPORTIONS OF HEARING LOSS, ARTICULATION DISORDERS, AND IMMATURE BEHAVIOR. ALSO, A NONDIFFERENTIATED GROUP OF CHILDREN WHO COULD NOT BE DIAGNOSED WAS FORMED. SEVERAL ITEMS TENDED TO LINK THE MENTAL RETARDATION, LANGUAGE DISORDERS, AND NONDIFFERENTIATION GROUPS. ALL WERE SLOW IN DEVELOPMENTAL ITEMS AND POOR ON FORM BOARDS AND GEOMETRIC DESIGNS. INTELLIGENCE TEST SCORES WERE BELOW NORMAL, HOWEVER, WHEN INTELLIGENCE POTENTIAL WAS ESTIMATED, THE CHILDREN WITH LANGUAGE DISORDERS WERE FOUND TO BE WITHIN NORMAL RANGE. THE NONDIFFERENTIATED GROUP ALSO IMPROVED 10 POINTS APPROACHING NORMAL RANGE. THE MENTAL RETARDATION GROUP DID NOT CHANGE FROM ONE TEST SITUATION TO ANOTHER. THE ARTICULATION DISORDERS AND IMMATURE BEHAVIOR GROUPS WERE FAR SUPERIOR TO OTHER GROUPS. CHILDREN WITH LANGUAGE DISORDERS MUST BE EDUCATED IN AN ENVIRONMENT THAT GRADUALLY REDUCES THE CHILD'S NEED FOR STRUCTURE RATHER THAN PERPETUATES THIS NEED BY PROVIDING STRUCTURE TO SUCH A DEGREE THAT THE CHILD'S ADAPTATION TO EVERYDAY CHANGE IS IMPOSSIBLE. AN URGENT NEED FOR NEW STUDIES OF THE WHOLE APPROACH TO THESE CHILDREN IN A THERAPEUTIC SETTING IS RECOMMENDED. (GC)

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# Communication Problems and Their Effect on the Learning Potential of the Mentally Retarded Child

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Western Reserve University and the
Cleveland Hearing and Speech Center
Cleveland, Ohio

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The research reported herein was performed pursuant to a contract with the United States Office of Education, Department of Health, Education, and Welfare.

# Dedication

This report is dedicated to the memory of the late George J. Fortune, former Director of the Cleveland Hearing and Speech Center, who was responsible for the initiation of this project, and to the late Rose Fine, former secretary to the project, who worked diligently toward its completion.

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As in any project of these dimensions, ideas, energy and continued interest must culminate from many sources. Listed below are the names of staff, consultants, and visiting lecturers who contributed immeasurably to the organization and expedition of this study.

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# TABLE OF CONTENTS

| | | Page |
|---|---|---|
| **Section One** | | |
| | Introduction and Background | 1 |
| | Procedures | 8 |
| | Results | 9 |
| | Conclusions and Recommendations | 10 |
| **Section Two** | | |
| | Introduction and Background | 12 |
| | Procedures | 22 |
| | Results | 51 |
| | Conclusions and Recommendations | 96 |
| **Section Three** | | |
| | Introduction and Background | 109 |
| | Procedures | 111 |
| | Results | 116 |
| | Conclusions and Recommendations | 126 |
| **Abstract** | | 129 |
| | Appendices: (Including Tables) | |
| **Appendix A.** | Items Used in the Correlation Matrix | A-1 |
| **Appendix B.** | Language Evaluation Record Form | B-1 |
| **Appendix C.** | Explanation of Record Form 1: History and Test Data | C-1 |
| **Appendix D.** | Explanation of Record Form 2: History and Test Data | D-1 |
| **Appendix E.** | Tables (See following List of Tables) | |
| **References** | | R-1 |
| **Figures and Data Records** | | |
| | Figure 1 - The Physical Plant | fol. 22 |
| | Record Form 1 - History and Test Data | fol. 50 |
| | Record Form 2 - History and Test Data | fol. 112 |

## LIST OF TABLES

Table No.

Causal Factors for Delayed Speech and Language Development, Distribution of Primary Classification 1

Previous Unclassified Group 2

Possible Loadings for Factors I and II, (Prev. Unclassified) 3

Continuous Variables, Total $\overline{503}$ Group 4

Single Dichotomous Variables, Total $\overline{503}$ Group

Race, Sex, and Socio-Economic Status 5
Prenatal History Items 6
Birth and Neonatal History Items 7
Postnatal History Items 8
Medical Diagnoses 9
Behavior Problems Reported by Parents 10
Behavior Problems Reported by Examiners 11
Objective Test Items 12
Speech Classifications 13

Combined Dichotomous Variables, Total $\overline{503}$ Group 14

Diagnostic Categories, Total $\overline{503}$ Group 15

Comparison of the Diagnostic Categories, Total $\overline{503}$ Group

Continuous Variables

Locomotion Variables 16
Speech Variables 17
Self Help Variables 18
Age and Birth Weight Variables 19
Intelligence Variables 20

Single Dichotomous Variables

Socio-Economic Status of the Parents 21
Race and Sex 22
Prenatal Problems 23
Birth Problems: Presentation, Labor, and Delivery 24
Birth Problems: Conditions Present at Birth 25

Three Combined Dichotomous Variables, Three Diagnostic Categories 26

Single Dichotomous Variables

Postnatal Problems 27
Medical Diagnoses 28
Behavior Problems Reported by Parents, Part I 29
Behavior Problems Reported by Parents, Part II 30

Table No.

Single Dichotomous Variables (Continued)

Behavior Problems and Test Responses Reported by Examiners 31
Objective Test Items 32
Speech Developmental Level 33
Speech Articulation Problems 34

Combined Dichotomous Variables 35

Composition of the Diagnostic Categories, Total 503 Group 36

Comparisons Among Diagnostic Categories, Total 503 Group

Age Walk in Months, "Pure" Sub-Groups 37
Age Words in Months, "Pure" Sub-Groups 38
Age Sentences in Months, "Pure" Sub-Groups 39
Tested I.Q., "Pure" Sub-Groups 40
Estimated Potential I.Q., "Pure" Sub-Groups 41
Age Walk in Months, "Mixed" Sub-Groups 42
Age Words in Months, "Mixed" Sub-Groups 43
Age Sentences in Months, "Mixed" Sub-Groups 44
Estimated Potential I.Q., "Mixed" Sub-Groups 45
Tested I.Q., "Mixed" Sub-Groups 46
Age Walk in Months, "Total Mixed without M/R" only 47
Age Words in Months, "Total Mixed without M/R" only 48
Age Sentences in Months, "Total Mixed without M/R" only 49
Tested I.Q., "Total Mixed without M/R" only 50
Estimated Potential I.Q., "Total Mixed without M/R" only 51

Combined Dichotomous Variables, Total 503 Group Categories

"Pure" Diagnoses Only 52
"Mixed" Diagnoses Only 53

Tested I.Q. and Estimated Potential I.Q., Total 503 Group

Comparisons within the Diagnostic Categories 54
Comparisons within the Sub-Groups of the Diagnostic Categories 55

Comparisons of the Sub-Groups of the Diagnostic Categories of the Total 503 Group, Age Walk, Age Words and Birth Weight 56

Pearson Product-Moment Correlations Between Age Walk, Age Words, and Age Sentences vs. Both Tested and Estimated Potential I.Q. Scores for the Total 503 Group and for Sub-Groups as Indicated 57

Continuous Variables, Total T-50 Group 58

Single Dichotomous Variables, Total T-50 Group

Race, Sex and Socio-Economic Status 59
Prenatal History Items 60

Table No.

Single Dichotomous Variables, Total T-50 Group (Continued)
    Birth and Neonatal History Items 61
    Postnatal History Items 62
    Medical Diagnoses 63
    Behavior Problems Reported by Parents 64
    Behavior Problems Reported by Examiners 65
    Speech Classifications 66
    Objective Test Items 67

Combined Dichotomous Variables, Total T-50 Group 68

Comparison of Continuous and Combined Dichotomous Variables, Total T-50 Group and the N/D Diagnostic Category of the Total $\overline{503}$ Group 69

Diagnostic Categories, Total T-50 Group 70

Continuous Variables in the "Pure" M/R Diagnostic Category, T-50 Group (Total N = 5) 71

Comparisons, Sub-Groups
    Continuous and Combined Dichotomous Variables
        "Pure" L/D Sub-Group, T-50 Group and Total $\overline{503}$ Group 72
        "Mixed" L/D + M/R Sub-Group, T-50 Group and Total $\overline{503}$ Group 73

    Continuous Variables, "Pure" L/D and "Mixed" L/D + M/R Sub-Groups of the T-50 Group 74

    Dichotomous Variables, "Pure" L/D and the "Mixed" L/D + M/R Sub-Groups of the T-50 Group
        Combined 75
        Behavior as Reported by Examiners 76
        Objective Test Items 77
        Judgment of Relationships 78
        Observations During Psychologic Testing 79
        Observations During Therapy 80

Comparisons of I.Q. Scores Before and After Therapy, T-50 Group
    Total T-50 Group 81
    "Pure" L/D Sub-Group 82
    "Mixed" L/D + M/R Sub-Group 83
    "Pure" M/R Sub-Group (For Inspection Only) 84

Comparison of the Sub-Test Items of the Hiskey, "Pure" L/D Sub-Group with the "Mixed" L/D + M/R Sub-Group of the Total T-50 Group 85

# SECTION I

## Restrospective Analysis of History and Test Data

## Introduction And Background

Delayed speech and language development can have many causes, one of which is mental retardation (175). In fact, one of the most difficult decisions that must be made in the differential evaluation of delayed speech and language disorders involves the separation of other problems from that of mental retardation. Basic to a discussion of this problem is the way in which mental retardation is defined. Assuming that the term mental retardation refers to a reduced mental capacity in all functions that are basic to learning, it is logical to conclude that the mentally retarded child will be delayed also in the acquisition of speech and language. However, if a child is delayed in the acquisition of speech and language for reasons other than mental retardation, it is assumed that he should function at a normal, or near normal level on test items that do not examine him in his special area of deficiency. Basically, it is these normal capacities that should make it possible for children who are not mentally retarded to compensate, at least partially, for their communication disorders. For this reason children with such problems as language disorders, hearing loss, or emotional disturbance must be considered different from normal children in kind rather than degree, whereas the mentally retarded child is different in degree rather than kind. The major difference is that the mentally retarded child has a reduced ability to learn adequately from any experience within his environment, while children with language disorders, hearing loss, or emotional disturbance are unable to learn from certain types of experience, depending upon their individual problems.

Mental retardation, when severe, can be differentiated from other problems with a fair degree of certainty, but it is difficult at times to make this clinical differentiation in children with complex communication disorders. Since standardized mental tests require communication between child and examiner, a communication problem alone could result in a child's reduced ability to perform at maximum level, and this in turn, could result in erroneous diagnoses of mental retardation. This point was demonstrated clearly in a pilot study which served eventually as a springboard for the larger project which is reported here. A brief discussion of pilot study findings follows:

From 1952 to 1956, a large number of young children were referred to the Cleveland Hearing and Speech Center (hereafter referred to as the Center) because they were not developing speech with the expected accuracy or at the expected time. In order to study the causal factors of their delayed speech and language development, 1200 consecutively selected case histories of children between the ages of three and six years were culled from the files of the Center for purpose of analysis. The case histories contained medical reports and the results of hearing, psychological, and speech evaluations. Prior to the analysis of these histories, classifications of causal factors were selected and defined as follows:

Hearing Loss: an average binaural loss of 30 decibels or more in the speech range, caused by involvement of the peripheral hearing mechanism without disturbance to the central nervous system, or other complicating factors.

Mental Retardation: a lowered intellectual capacity, classified as permanent retardation (I. Q. below 70), regardless of causal factors.

Emotional Disturbance: a nonorganic problem with causal factors stemming from problems within the environment, resulting in a refusal of the child to respond adequately to environmental stimuli.

Environmental Factors: a nonorganic problem resulting from over-protection, neglect, inconsistent handling by parents or guardians, or any factor that tended to produce an ineffective speech stimulation atmosphere.

Delayed Development: a general delay in all developmental aspects with indications for normal potential.

Language Disorders: inability of the child to use symbols for communication purposes, resulting from cortical damage, or maldevelopment of the cortex.

Multiple Problems: any combination of any of the above classifications.

Using these definitions, the 1200 histories were analyzed so that a primary classification could be assigned to each child's problem. Examination of these histories showed that the primary causal factors for delayed speech could be clearly determined for 852 of the histories selected, but 348 remained unclassified. Table 1* shows the distribution of assigned classifications. One of the most important observations resulting from this analysis was that causal factors of delayed speech and language development were unclassified in 348 cases because the children in that group were untestable by routine standardized test batteries, or their responses were so inconsistent that test results fluctuated showing significant variation between test situations. In other words, if consideration were given only to the test behavior of these children, the primary classification for the entire group might have been mental retardation.

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* Because of the numerous tables prepared for this study, they have been assigned to Appendix E so that the continuity of the text will not be interrupted.

Since the examiners were unwilling to use the term "mental retardation" to describe this group, it was decided that an attempt be made to recall as many of these children as possible, so that a more penetrating re-examination could be completed. However, for various reasons such as lack of parental interest, geographical limitations, or lack of parental motivation, 109 of those children were not examined further. It should be noted that no child was excluded from further study because of the parents' inability to assume additional financial obligations, since this service was rendered without charge, when needed.

Prior to scheduling the 239 children who were restudied, an attempt was made to unify the examination procedures so that examiners could be alerted for certain types of information important in the classification of children's communication disorders. This information included the physical condition of each child, obtained from the child's pediatrician or family physician; in the absence of reports from either of these two sources, the child was seen by the Center's pediatric consultant. Psychological reports were requested from psychologists who had examined the child previously, and if none were available, examination was completed by the Center's psychological consultant. Auditory acuity was evaluated by one of two clinical audiologists at the Center, using pure tones, noise makers, social noises, and verbal commands presented in a calibrated and controlled sound field. One of the Center's three speech pathologists estimated development in the motor, laterality, and speech areas. The Vineland Social Maturity Scale (23) was used to determine the level of social competence for each child and was administered by either the clinical psychologist or one of the speech pathologists trained in the use of this scale. Each case was staffed individually by the members of the diagnostic team who had examined the child, and the problem was classified by integrating the history of the problem with observations of behavior and test results.

Table 2 shows the distribution of primary classification of causal factors for the 239 children re-examined. As can be seen, 50 children (21 per cent) were found to have permanent mental retardation as the primary problem precluding speech. However, it is important to note that 23 (10 per cent) were found to have a hearing loss; 52 (22 per cent) were emotionally disturbed; and 90 (37 per cent) were found to have language disorders as primary causal factors for delayed speech development. None of these problems had been clearly delineated during previous examinations.

It should be noted also that none of the problems in these groups was related to environmental factors or to a generalized delayed development with normal potential. In other words, all of these children were considered to have basic disorders and not those produced by environmental factors or problems they could be expected to "outgrow". Even with some attempt to unify the evaluations, there were 10 (four per cent) still unclassified at the termination of the re-examination. However, this was a considerable reduction from the 29 per cent who were previously unclassified.

It was apparent that a more adequate method of evaluation and differentiation of these problems was needed. Although the approach to the differential evaluations as described above was the only manner in which the re-examinations could have been done at that time, it was also apparent that there were certain inadequacies in these procedures:

(1) There was a lack of structure and control in the selection of tests or history items. The psychological consultant to the Center arbitrarily selected varying assortments of intelligence scales in order to make clinical judgments. Some of the reports obtained from psychologists outside the Center consisted of test scores only, without information concerning the behavior of the child while being tested.

(2) The participating examiners were not the same for each child. Reports were obtained from many different physicians and psychologists, who, no matter how competent, reported findings in such different ways that comparative studies between the diagnostic groups or within these groups were not possible.

(3) There were variations in methods used to record history items. There was no planned order used in recording history or behavior items so that specific types of information, when available, had to be gleaned from the case history as a whole.

It should be emphasized that the procedures used in these re-examinations were not unlike those used in speech and hearing centers throughout the country and were considered quite adequate for general clinical purposes. It became apparent, however, that there would be less chance for error in clinical judgment if the diagnostic procedures and instruments, as well as the staff, remained constant through all examinations. This thinking later became the basis for a proposal to study a new series of children.

Before attempting a more definitive approach to differential evaluations, however, it was necessary to determine if it might be possible to put together a more refined battery of history questions. Consequently, the history items used in the pilot study were analyzed for the purpose of detecting any patterns or duplication of items that might emerge from such an analysis. A discussion of the procedures used to analyze these history items follows.

## Procedures

Accumulation of data: The first step in our attempt to analyze case history items entailed a series of meetings with members of the Center Staff in order to consider various types of information (usually obtained from parents or specific examinations) that had been considered effective in the differential evaluation of delayed speech and language disorders. Conferences were also held with specialists throughout the country in order to obtain additional ideas concerning the validity or reliability of such items. As a result of these discussions, a list of some 140 items, suggested by physicians, psychologists, audiologists, speech pathologists, and educators, emerged. It then became necessary to analyze these items, eliminating some because of ambiguity, others because of overlap, and still others because it was known that the information would not be available in the case histories to be analyzed. Through a process of elimination, 78 items were finally listed and coded.

During the period of time when these items were being discussed and sorted, other children with delayed speech and language development were being examined at the Center. Of the total three-to-six year old population seen during this period, more than 169 were similar in behavior to the 239 previously re-examined. Therefore, it was decided that these histories should also be studied, bringing the total number of histories to be analyzed to 408.

The 408 case histories were analyzed by record analysts familiar with the histories of these children and supervised by the Intake Supervisor of the Center who had examined the majority of the children whose histories were being studied. The selected items, as coded, can be seen in Appendix A.

Treatment of accumulated data: Because of the large number of data resulting from this study, it was necessary to select a statistical method that could meaningfully organize the numerous history and test items. Therefore, the technique of Factor Analysis was used. This analysis consisted of 78 separate items of information concerning 408 children, resulting in the construction of a large matrix containing correlations between all possible pairs of items. A tetrachoric or point bi-serial correlation was computed for those pairs of discrete variables which did not lend themselves to a computation of a product-moment correlation. In any case, standard formulae were used for all statistical computations.

## Results

Two factors were extracted by the Thurstone centroid method, and they can be seen in Table 3. Although Factor I might conceivably be thought of as an organic component and Factor II seems more closely related to a communication component, it would be presumptuous to dignify them by attempting to assign a name to either. In fact, either factor might have been predicted beforehand, since many of our items were so structured to sample heavily the medical and communication aspects of the child's history. Therefore, the appearance of these second factor residuals did not encourage further formal analysis.

It did not seem reasonable, however, to ignore the isolated coefficients which might not contribute at all to the loadings on either of the two factors extracted, but which could be of considerable interest in and of themselves. Although many of these correlations were sufficiently large to warrant consideration, none yielded information that is not obvious (such as the correlation of .73 between Meningitis and the Use of Medication) or common knowledge (such as the correlation of .95 between Behavior Change Following Illness and Encephalitis). Since this approach to the organization of such data was not fruitful, the retrospective aspects of the study were abandoned in favor of an anteretrospective approach.

## Conclusions and Recommendations

In summarizing this section of the study, three salient points appear worthy of comment.

(1) The technique of Factor Analysis was not considered an ad-

vantageous method of analyzing information obtained from case histories that were inspected retrospectively. Although it is conceivable that second factor residuals might emerge from this treatment approach to such data, the factor loadings might be inherent in the emphasis given to the information obtained.

(2) Superficial examination of children with delayed speech and language development can result in erroneous diagnoses of mental retardation; therefore, more carefully delineated analyses of history items, observations of behavior, and test results are mandatory before a justifiable classification of mental retardation can be made.

(3) There appears to be less chance for error in clinical judgment if diagnostic procedures, instruments, and staff remain constant and if the information resulting from each evaluation series is coordinated and staffed prior to classification or disposition of the case.

On the basis of these three points, our need to study a new series of children using the same selected diagnostic procedures, instruments and staff was re-emphasized. It was apparent also that a different approach to the treatment of these data was needed. The segment of the study combining these two needs is reported in Section II, which follows.

# SECTION II

## Anteretrospective Analysis of History and Test Data

## Introduction and Background

This segment of the project involved the study of a new series of children who are examined by the same diagnostic staff using a specific battery of history and test items. As concluded in Section I, it appeared that by having standard procedures carried out by the same examiners, a more careful evaluation of children with delayed speech and language disorders would be possible, and perhaps a more conclusive method of differentiating their problems might emerge.

Prior to the selection of test items, articles and texts pertaining to various aspects of communication disorders in children were read and discussed by the diagnostic staff. This was done so that we might benefit from information obtained from previous studies. We were particularly interested in reports concerning the effect of communication disorders on the learning potential of the mentally retarded child. Basically, this search through the literature included the results of specific studies and theories, points of view, ideas or even somewhat nebulous thoughts about the possibilities of clinically differentiating pseudo-mental retardation from that of mental retardation itself.

At first and somewhat cursory glance, there appeared to be a dearth of information that applied directly to the study under discussion. There were literally volumes written about the mentally retarded child, but the majority of this information seemed to have only tangent relationships to the population to be studied here. There were also numerous reports on the deaf child with rather concise summaries of the clinical characteristics of deafness and somewhat detailed discussions of suggested training procedures for those children. The emotionally disturbed child was discussed from various view points, such as that of psychiatry, psychology, child development, and special education. Even studies relating to language disorders in children, which, although studied for many years, has become a more formal area of study during the last decade, were scattered throughout the literature and suggested some interesting and thought provoking theories. But with all of this information available, it was still difficult to apply much of it to the study under discussion. It appeared, then, that one way such information could be reviewed would be to divide the literature into major clinical classifications and discuss each area with a certain separateness. Although delayed speech and language can be caused by many factors, of major concern to speech and language pathologists are the problems of mental retardation, hearing loss, emotional disturbance, and language disorders. Therefore, these areas were selected for review here.

Mental retardation probably occurs with greater frequency and is responsible for more parental anxiety than any other problem in children, whether congenital or acquired (165). And with all of our studies of mental retardation and suggestions for training or education, there are always obvious limitations as to what can be done to help these children become even partially productive citizens, in a complex society that is becoming more and more complex everyday. For this reason, the diagnosis of mental retardation must have supportive evidence, and every possible avenue of the child's potential must be explored to be sure that the problem is, in fact, that of mental retardation and not some other problem that might be remedial to some extent if accurately differentiated (40, 69, 159, 175). Seemingly, this was the pattern of the thinking found in the discussions concerned with mental retardation.

There are certain behavior patterns and responses that we have learned to expect from the mentally retarded child (2). For example, he is usually slower in developing motor skills (70); unable to learn basic subjects in school (146); severely delayed in the acquisition of speech (41, 78); and limited in both concrete and abstract thinking (168). We also know that mental retardation can be caused by any assortment of factors, such as endocrine disorders (133, 184); damage to the central nervous system (21, 33, 34, 79, 86, 96); birth problems such as prematurity (80); or familial patterns (68). Because of its many possible etiologies, mental retardation is no respector of race, sex, or socio-economic level and regardless of cause, institutions cannot house all of the children who currently are classified as mentally retarded (159). For this reason, there is a decided need to educate and guide parents in training procedures for these children so that some help can be obtained for them at home(31).

To aid in these procedures, numerous studies have been under-taken in an attempt to find new methods for studying the different causes of mental retardation (19, 22, 87, 141, 149) with the hope that additional methods of educating or training these children might become available. Since the ability to communicate with others is no luxury but rather a social necessity, specific studies have been devoted to the evaluation and therapeutic approach to the mentally retarded child with concomitant communication disorders (24, 38, 77) and to the differentiation of aphasia (73, 144), hearing loss (176), and emotional disturbance (95), from mental retardation.

Usually, physicians and psychologists can determine the mental level of children with endocrine disorders, such as mongolism (184) and those having familial patterns of mental retardation (68), with a fair degree of accuracy and ease. But the child who is mentally retarded as the result of cerebral damage presents a much more complicated clinical picture and requires a more complex evaluation series (35, 132, 135, 137, 149, 177). The child who is mentally retarded as a result of cerebral damage may confuse examiners since, unlike the child who is retarded because of endocrine disorders or familial causes, he may not respond at a consistently lowered level in all activities. In fact, the quintessence of the brain damaged retardate is "inconsistency", not only in his varying abilities but in his day to day performance of activities in which he is known to be competent. For this reason, no single evaluation will be able to tap the many facets of the mentally retarded child with cerebral damage (127).

The psychopathology of children with brain damage has received much attention in the recent past (7, 121, 136, 155), and it has been pointed out that cerebral damage can be causally connected with many childhood disorders other than mental retardation (149, 154, 156). Of particular interest to many investigators is the aspect of perception and the effect of perceptual disorders on the intellectual performance of children with cerebral damage (154, 155). In fact, it is suggested that perceptual disorders, particularly in the visual area, may be a factor of pseudo rather than true mental retardation (132, 135, 177, 183). Therefore, studies have been made of the processes involved in learning perceptual skills (1, 44), and suggestions for the integrative therapy (82, 154) considered necessary in educating children with perceptual disorders have emerged.

Brain damage has been associated also with certain types of hearing loss (43), particularly those types where involvement of the inner ear, auditory nerve, or auditory association pathways of the brain is suspected. With this type of hearing loss, more than with conductive losses, a detailed and differential evaluation of the child's problem is necessary in order to determine what factors, if any, are complicating the clinical picture (81, 118). The procedures used to evaluate and educate children with conductive losses have been tested rather thoroughly and found to be successful, but the child with a hearing loss stemming from cerebral damage may not benefit from those procedures (120, 150). For this reason hearing loss must be differentiated from such problems as auditory agnosia (15, 76, 140) or auditory imperception (3).

Loss of hearing must be differentiated also from psychotic behavior, since a psychotic child with normal hearing may effectively ignore sounds if his illness so necessitates (114). Because of this lack of response, the psychotic child may be misdiagnosed and erroneously classified as mentally retarded or deaf (74). There are at least five rather clearly crystallized categories of emotional disturbance in children: symbiotic-parasitic psychosis (97), early infantile autism (74), irreversible anaclytic depression (153), childhood schizophrenia (7), and childhood psychosis resulting from brain damage (14, 114).

It has been stated clearly and well that the psychotic child can be differentiated from children with other types of disorders, primarily on the basis of the way in which these different types of children relate to other people (114). For example, the mentally retarded child may be delayed in speech acquisition and motor skills; he may have signs of physical stigmata or congenital deformities associated with mental retardation; but in the absence of such clearly recognized delayed - or mal-development, one fact stands out: compared with the psychotic child, the retarded child always relates to people quickly, obviously, and usually warmly (114). The child with a hearing loss also is delayed in the acquisition of speech; he may have a motor problem due to vestibular involvement; and he responds to sound only when the intensity level supercedes his sensory deficit. But he is usually a friendly child and makes definite identification with people around him. Fortunately the majority of specialists in childhood psychoses are quick to point out that classifications of children's emotional problems, in and of themselves, are meaningless. No child can be assigned with isolated separateness to one category and one category alone (74,95, 114).

Those who have studied the many factors that may preclude speech and language development also support this premise, unquestionably (26, 45, 53, 54, 71, 72, 83, 94, 110, 111, 131, 143, 161, 171, 180, 181). Studies of the development of speech and language in the young child conclude, generally, that a child must have adequate intellectual abilities, normally functioning sensory pathways, and certain psychological integrities before he can meaningfully use speech for communication purposes (16, 46, 91, 93, 94, 101, 115, 123, 130, 147, 148, 170, 183).

In order to understand more clearly the many factors that may preclude speech and language development, studies of normal children, in terms of learning processes (55), reasoning (172), judgment (142) and parent-child relationships (102), have been reported. These studies have established with a fair degree of certainty when a normal child first speaks words, phrases, or sentences. We know, for example, that a child uses nouns first, then verbs, then other parts of speech. We know also that vowels are acquired first and then consonants (101). This information is of utmost importance to the study of language disorders in children.

Although language disorders in adults, and particularly the problem of aphasia, has been studied and discussed for more than a century (169), the earliest reference to childhood aphasia we could find was made in 1911 (100). Since that time, many have discussed the problem of congenital aphasia (17, 28, 32, 36, 47, 60, 75, 103, 116, 117, 139, 157, 159, 160, 162, 163, 174, 182, 185).

The term language disorder refers to an inability to use symbols for communication. Aphasia indicates only one type of language disorder: the inability to receive or express spoken symbols. It does not refer to disorders in the reception or expression of written symbols. Alexia is the term used to indicate a problem in the reception of written symbols; alexia is, therefore, a reading disorder (8, 64, 109, 142, 145, 164, 166, 167). Agraphia, on the other hand, refers to a problem in the expression of written symbols, or a writing disorder (118). It is important to note that alexia and agraphia are inter-related since it is necessary to be able to read before one is able to write. There are still other terms used to indicate other types of language disorders, such as acalculalia (inability to comprehend the meaning of numbers); amusica ( a disorder in the use of music symbols) etc., (180). It is apparent that of all the language disorders, the problems of aphasia, alexia, and agraphia are of primary concern to educators, speech and language pathologists, and to the present study (179).

One of the major causes of aphasia and other language disorders is cerebral damage (10, 20, 29, 50, 108, 116, 121). Although these problems are usually congenital in origin (151), they can also be acquired (88, 99), developmental (113), or even familial (27). Differential evaluation of language disorders in children requires careful and detailed consideration of the many facets of child development (119, 124, 152, 178) and they must be differentiated from mental retardation (10, 98, 173), hearing loss (105, 138, 186), and emotional disturbance (89, 108, 180). In addition, aphasia must be differentiated from apraxia (125), dysarthria (112), or both (92). Children with language disorders may have behavior similar to children with other problems (119, 124, 128); in fact, language disorders are often found to be a complicating factor in children known to have other problems (152, 178). But it must be emphasized that a child cannot be said to have a language disorder unless his primary problem is related to his inability to receive, express, or understand symbols. In other words, he is expected to function at a normal or near normal level on non-symbolic tasks, and his major deficit is an inability to use abstractions on a symbolic level (178).

Because of this, the education of the aphasic child is, of necessity, different from that of children who have other problems (6, 9, 65, 67, 84, 85, 104, 122, 129). The aphasic child needs help in organizing incoming stimuli for meaningful communication with others. Most often these children are not accepted in the public schools for education, and at the present time private clinics or residential schools are unable to supply the necessary services for all of the children who need this special kind of education (35, 179).

The problem of alexia, sometimes referred to as "congenital word blindness" (48, 49, 52, 56, 57, 58, 59), is not recognized as early in a child's life as the problem of aphasia. This, of course, is partially by definition. Nevertheless, there are early signs, such as inversions or reversals in drawing prior to reading age, that can predict reading problems with a fair degree of accuracy (11). Studies of visual perception have indicated that new tests may be forthcoming (39, 155). There are many types of reading disorders other than alexia (5, 118) and differentiation within these problems must be made. This can be done adequately by using tests designed to evaluate reading disorders (61), with predictions of possible success levels and expectations (12, 13, 62, 63). But with reading disorders, as seemingly with all other types of children's disorders, sufficient clinical services are not currently available. (13).

This review of the literature accents two major points: (1) No child's problem, regardless of cause or degree, should be viewed in isolation. There is not only a need for various diagnostic viewpoints, but these opinions must culminate into a clinical recommendation that suggests what, if anything, can be done to alleviate or improve the child's condition. (2) Studies of delayed speech and language development, because of the many causal factors, require careful examination of the sometimes immeasurable behavior components if recommendations for training and education are to emerge.

This, then, was where we began our study of a new series of children who were referred to the project staff for examination because of delayed speech and language development. A discussion of the procedures used follows.

## Procedures

The following discussion of the procedures carried out by the diagnostic staff on this new series of children with delayed speech and language development is divided into four sections: The Physical Plant, Selection and Administration of Tests, Staffing and Classification of Subjects, and Methods Used to Record and Treat Data.

### The Physical Plant

A. The General Floor Plan: The floor plan of the total physical plant used in this project can be seen in Figure I. The design and construction of these rooms, which are housed in the entire top floor of the new section of the Center, was made possible by a generous grant from the Beaumont Foundation*. The total clin-

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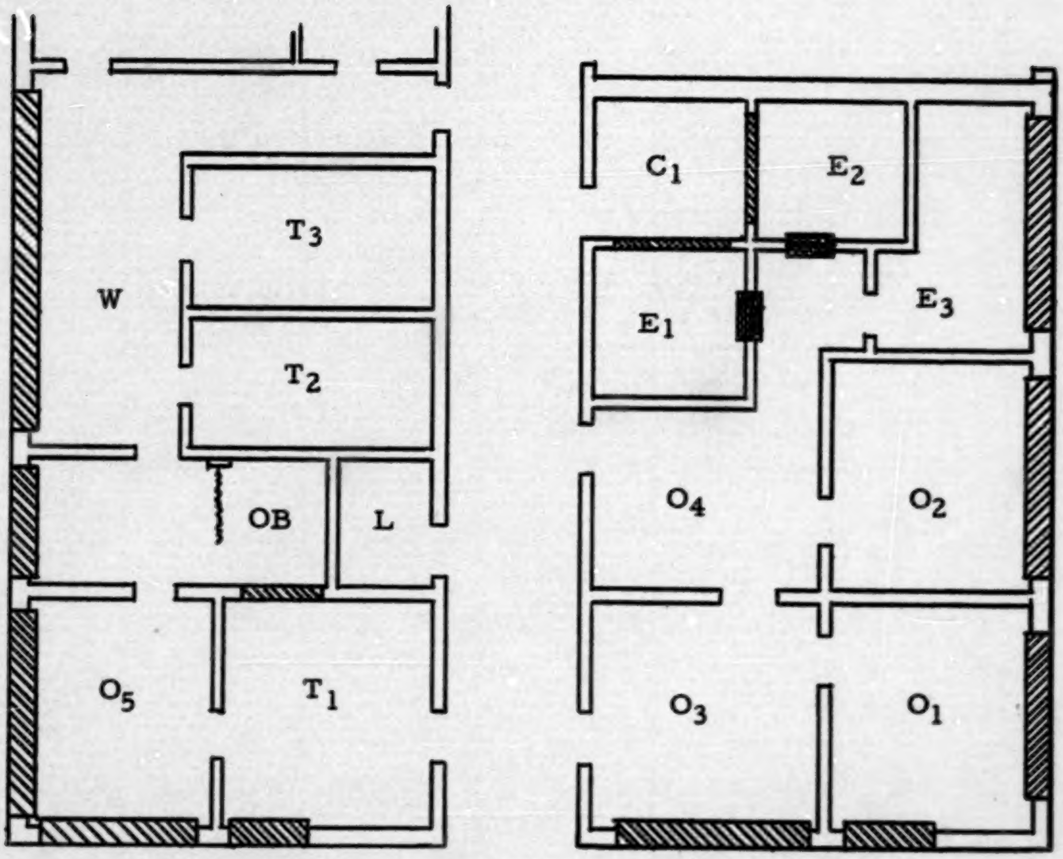
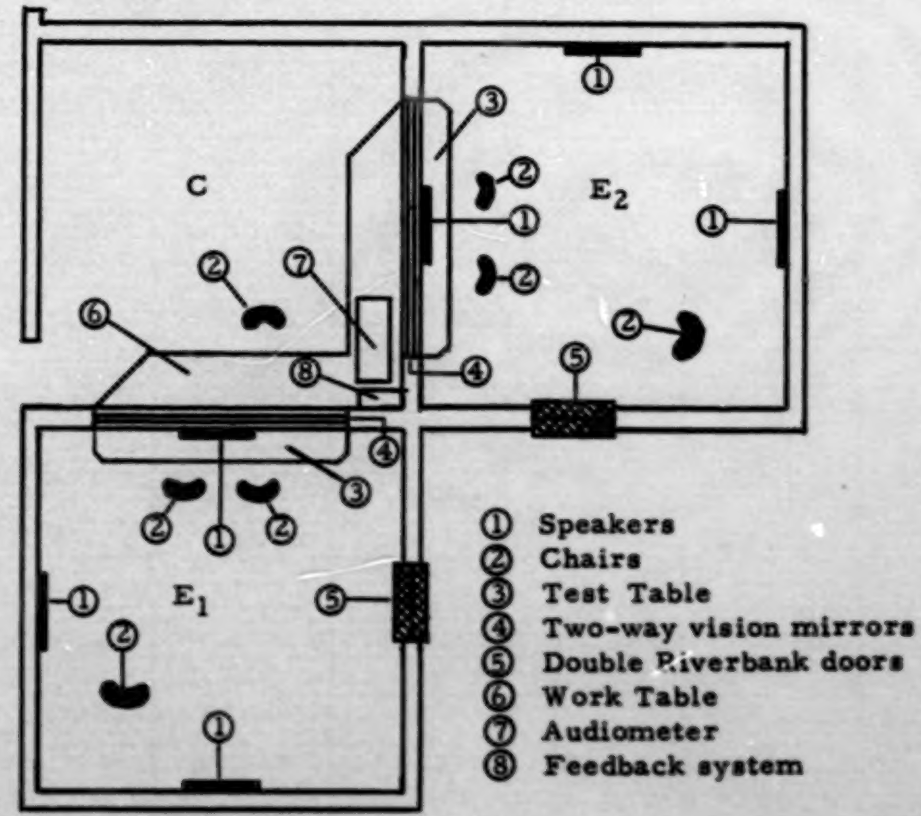
* These rooms were constructed at a total cost of over $35,000.00 given by the Beaumont Foundation to aid in the study of language disorders in children. It was partially through these facilities, including diagnostic sound-isolated rooms, psychological laboratory, and clinical facilities for observation of behavior, that the collection of the existing data became possible.


W
T3
T2
OB
L
O5
T1
C1
E2
E1
E3
O4
O2
O3
O1

LEGEND:

| | | | |
|---|---|---|---|
| C. | Control Room | OB. | Observation Room |
| E. | Examination Room | T. | Therapy Room |
| L. | Lavatory | W. | Waiting Room |
| O. | Office | | |


C
E2
E1
①
②
③
④
⑤
⑥
⑦
⑧

① Speakers
② Chairs
③ Test Table
④ Two-way vision mirrors
⑤ Double Riverbank doors
⑥ Work Table
⑦ Audiometer
⑧ Feedback system

THE PHYSICAL PLANT

ical structure consisted of five offices, three examination rooms, three therapy rooms, an observation room, a waiting room, and a control room. As can be seen, the examination section was separated from the therapy section by a large hallway, which served to reduce the distractions that one activity might impose upon the other. The rooms were air-conditioned, and of cinder block and plaster construction, affording additional acoustic isolation so that activity in any given room did not interfere with whatever interviews, therapy, or testing might be taking place in adjacent rooms. Offices $O_1$ and $O_2$ were used for initial examination of children who came through intake channels, while offices $O_3$ and $O_4$ housed the secretarial services and files for the project. Examination Room $E_3$ was used for psychological examination or parent conferences, and the Test Suite, which consisted of two examination rooms and a control room, ($E_1$ and $E_2$ and C.) was used for the evaluation of language disorders. On the other side of the hallway, which was designed primarily for therapy, one office $O_5$, was used by the Supervisor of Therapy for parent conferences. This office was adjacent to a large Therapy Room, $T_1$, in which small groups of children could be scheduled for therapy and observed through the large two-way vision mirror which separated the therapy room from the observation room, OB. The Observation Room was equipped with a play-back system, allowing parents, therapists, and others to observe procedures in $T_1$ with the added value of audition.

The waiting area W, outside the two therapy rooms $T_2$ and $T_3$, was large enough to accommodate approximately four children and their parents. Both of the therapy rooms ($T_2$ and $T_3$) were well ventilated, but windows were omitted in order to reduce possible visual distraction, a necessity in planning therapy for children with language disorders. Selection of color was also considered in an effort to reduce visual distractions: $T_3$ was painted a soft green and $T_2$ a light tan. The floors of both therapy rooms were covered with rubber tile which matched the walls, and the ceilings were treated with fissured mineral tile in an effort to minimize the sound level within the rooms and to reduce possible interference of noise from the waiting area, or the adjacent room. The ceiling of the waiting area was also acoustically treated, and the walls, like the outer walls of the entire physical plant, were painted a rose-tan, which according to the parents, was a pleasant departure from the usual "institutional green".

B. The Experimental Test Rooms: The enlarged section of Figure 1 shows in more detail the two specially constructed Test Rooms, $E_1$ and $E_2$, and the adjacent Control Room, C. The test rooms and the control room were identical in size, measuring eight feet in all three dimensions, and were of double wall construction with double ceilings and provision for quiet ventilation. East test room was separated from the control room by a two-way vision mirror. There were three speakers in each test room, permitting sound to reach the subject from any one of three directions: front, side, or rear. The speakers were placed in these positions so that the overt reactions of the child, in turning toward the source of the sound, frequently gave a clue to the fact that he heard the sound, although he may have purposely or otherwise given no other reaction to indicate that the stimulus had been received. These procedures often reduced the number of children who may otherwise have been referred to the audiology department for evaluation, and they also tended to maintain the child's interest during specific test sequences, since the source of the sound was not readily known.

The ambiant noise level in the test rooms was sufficiently low to permit testing at normal threshold. It was not possible to isolate against strong impact sounds from the rest of the building, but since the administration of audiological examinations was not planned for these rooms, the noise level was considered more than adequate.

To minimize the effect of sounds created by the child during the examination and to preserve maximum clarity and directionality of sound stimulation used, the floor of the test room was covered with a thick carpeting, and the ceiling was covered with a thick mineral tile, which extended approximately three feet down the walls. The lower section of each wall was covered with a tough plastic to insure minimum scarring or defacing resulting from the unpredictable behavior of this population of children.

As indicated previously, color is an element that must be considered in the planning of the environment of children with communication disorders. Because of this, the floor and wall covering were both a neutral gray, while the acoustic tile was a dulled white; these colors provided a relatively distraction-free visual environment.

Some versatility in the testing space was achieved by constructing the [illegible] so that they could be dropped flush with the walls. With this arrangement, extremely young and/or small children could be placed on the floor during examination, and their responses could still be observed from the control room without visual obstruction. Both test rooms had double Riverbank doors. Acoustic isolation was preserved at the doorways by use of a Riverbank door for the inner shell of the test room and the solid-core two inch door in the outer shell. Both of these doors were installed with rubber seals and acoustic drops. In addition to furnishing sufficient isolation, these tightly sealed double doors also controlled the activity of those children who attempted to leave the test room before the examination was completed. Since the test procedures required two examiners (one in the test room with the child and one in the control room), each test room was equipped with a monitor phone which, with the usual talk-back system in the control room, permitted communication between examiners with minimum distraction to the child. As a further consideration in the attempt to minimize distraction, the test rooms contained only limited equipment: test materials, two chairs, (one for the child being examined and one for the examiner), and a straight chair for a parent in case the child had a separation problem.

C. The Control Room: The Control Room was separated from the hallway by a single Riverbank door. The rubber tile which covered the floor was considered adequate and serviceable. A work table, in the shape of a carpenter's square, was fitted under both mirrors, providing work space for the examiner regardless of which room was being used. This single control room could serve either test room, so that it was possible to observe two children simultaneously for purposes of contrasting or comparing their behavior. To furnish a sound transmission system without interfering with the viewing area in the test room, a Belltone 15A Audiometer was recessed into the work table so that the dials of the audiometer were flush with the table surface. The control room talk-back system could be readily switched from one test room to another, or both rooms could be monitored simultaneously. Sound stimuli into the test room could also be switched, not only from room to room, but to any of the three speakers in each room, without a change in sound level. Within the limitations of sound field calibration, levels of pure tone and speech signals were set independently in such a way that zero on the audiometer dial meant threshold level at the position of the child's head. When using speech for stimuli, the examiner in the control room wore a chest microphone (not unlike those worn by switchboard operators) which allowed considerable freedom of movement without changing appreciably the distance between mouth and microphone. This arrangement allowed constant calibration at all times.

## Selection and Administration of Test Procedures

A. **Personnel:** The professional staff consisted of two medical specialists, a pediatrician and a child psychiatrist; a clinical psychologist and an audiologist, both of whom had had considerable experience with evaluation of non verbal children; two language pathologists, with strong backgrounds in child development; three language therapists, with long term experience in the therapeutic management of young children with delayed speech development; and two statisticians thoroughly familiar with the planning and execution of experimental designs. All of these staff members were known to have more than adequate knowledge of the many facets involved in the diagnosis and treatment of children with communication disorders. Through the able coordination of the pediatric consultant, other physicians in the fields of neurology and otology made excellent contributions. In addition, nationally recognized authorities in fields of speech pathology, audiology, and psychology participated on a consultative basis.

B. Scheduling: Scheduling of cases for examination was channeled from the audiology and speech pathology departments within the Center, since all children referred for examinations by the project staff were seen first by the intake personnel of the Center. All children who were not clearly differentiated or who were suspected of having multiple problems (like the original 408 unclassified children in the pilot study) were referred to the project staff for further study. It was from this larger sample population that the study population was selected. There was no specific pattern devised for scheduling this series of examinations, which meant that a child might be seen first by the medical consultant or the psychologist, depending upon which examination could be scheduled first. This was done so that the waiting time for appointments could be reduced. However, both the pediatric and psychologic examinations were scheduled prior to the speech and language evaluation. If other evaluations were recommended, such as audiologic, neurologic or otologic examination, they were scheduled following the speech and language evaluation. The project secretary scheduled the examinations that were to be completed by the Center and project staffs; the pediatric consultant, by directing reports to the child's own pediatrician or family physician, recommended additional evaluations, both medical and paramedical, when such examinations were needed. In this way, excellent cooperation was maintained among the project staff, the Center staff, and other professional people concerned with the welfare of the child.

C. Criteria for Selection of Subjects: Criteria used in this study for the selection of subjects were necessarily gross since more refined or specific criteria would have involved predictions that the staff was unable to make at that time. The selected population sample was characterized as follows: 1. between the ages of three and nine years; 2. delayed in speech and language development; 3. not classifiable by routine speech and hearing screening evaluations; 4. known to perform at a reduced level on tests of mental ability; and 5. suspected of having a higher potential level of performance on mental tests than their actual test performance indicated.

D. Description of Test Procedures: The test procedures were divided into four major classifications: 1. medical, 2. psychologic, 3. audiologic, and 4. speech and language. Following the examination series, each case was staffed individually; the history and behavior items were analyzed; and a primary classification was indicated for each case.

1. Medical Examination: Each child was examined individually by the pediatric consultant and attendance by one or both parents was required so that the medical history of the child could be obtained. If additional reports were needed, the pediatric consultant discussed the problem with the child's own pediatrician or family physician. Reports resulting from the project staff's examinations were forwarded to the child's physician by the pediatric consultant. The method of examination used will not be described here, since it was considered routine pediatric procedure, but the details concerning the classifications used for these examinations are described in Appendix C.

There was also a psychiatric consultant to the project who was available for consultation on referral from the pediatric or psychologic consultants. Although only the extreme behavior problems were usually referred to the psychiatric consultant, owing to the limited time available for each consultation, all children suspected of having emotional disturbance were referred for psychiatric evaluation. Some were seen by the staff of the Guidance Center; others by psychiatric department staffs of the various hospitals of metropolitan Cleveland or within the child's own geographical area; still others were referred to psychiatrists in private practice. The psychiatric consultant helped immeasurably in directing these families to the most suitable source for help. In all cases, at least three possible sources of referral were discussed with the parents or the family physician for consideration, so that single and direct referrals were avoided. This procedure is usually necessary in any community center. A discussion of the classifications and referral recommendations can be found in Appendix C.

2. Psychologic Examination: The psychologic examinations were administered in a large, comfortable room designed for such test procedures. Tests were easily accessible to the psychologist but out of reach of the child. It was possible to have either or both parents in the room, in cases where it was deemed advantageous, without distraction to the child. Chairs of varying heights were available to assure maximum comfort of the child during test procedures and the testing climate was considered adequate to obtain maximum results. The child was allowed sufficient time to adjust to his sur-

roundings, the examiner and the test environment; he was not pressured for response, although a standard test routine was maintained., Following the actual examination of the child, a conference was held with the parents so that additional information could be recorded concerning the home environment, family constellation, parental attitudes, and the child's developmental and psychologic behavior. If more time was needed for conferring with the parents or for examining additional aspects of the child, a second session was scheduled. A detailed report of the findings was prepared by the psychologist and discussed with the other members of the project staff after all examinations were completed. If during this staffing other information not obtained or not available at the first session was considered important to the total review of the case, the child and/or the parents were rescheduled so that further investigation could be made. The psychologist recorded not only the mental age earned by the child on the test battery, but also what appeared to be his potential mental age, on the basis of testing and other clinical evidence. This provided a prognostic blueprint that guided the project staff in decisions and recommendations and indicated possible success levels to the assigned therapist if the child were scheduled for additional clinical services.

In order to form a clinical judgment, the psychologist used an assortment of tests, selecting those batteries or items from batteries that seemed most pertinent to the evaluation of the individual child (4, 42, 66, 90, 126, 158). The Merrill-Palmer Pre-School Performance Test (107) and the Vineland Social Maturity Scale (23) were selected for administration to all children. This selection was made on the basis of ease of administration, accent on performance items rather than verbal ones, familiarity of the examiner with these procedures, and the provision both scales make for predicting the potential of children with delayed speech and language development. Since many of the subjects in this population were hyperactive, the need for ease of administration and familiarity with test materials was obvious. At the same time, tests with high verbal content could not be used since the children under study had delayed speech and language development. Both selected tests, because of their structure, permitted the examiner to see merging patterns, so that predictions for future potential could be made.

3. Audiologic Examination: The audiologic examinations were scheduled in a fairly large, two-room audiological testing suite, with provision for adequate visual contact between child and examiner. The ambiant noise level permitted test-

ing at normal threshold, with provisions for pure tone, speech and GSR testing sequences. The procedures used will not be discussed here, since they are considered fairly routine (140). The testing was completed by an audiologist with considerable experience in the testing of young, non-verbal children. A continuity report was prepared, in addition to the usual audiogram, and the audiologist participated in the staffing of those cases who had been referred for hearing evaluation. It was necessary at times to reschedule certain children for a series of evaluations before a clinical judgment could be formed. Rescheduling procedures were continued until maximum results were obtained or the child was considered untestable by standard procedures. If the child was considered untestable at the time, a temporary clinical decision concerning his auditory function was made, and re-examination was recommended.

4. The Speech and Language Evaluation: The speech and language evaluation, as designed and administered in this study, required the coordinated participation of two examiners, one in the examination room with the child being tested, and one in the control room. (See Floor Plan of Test Suite, Figure 1). The examiner in the control room recorded all scores during the evaluation, allowing the examiner in the test room

considerable opportunity to establish rapport with the child, control or direct the child's behavior during testing, and maintain the pace of the examination.

Since no standardized battery for the evaluation of language disorders in children was available for use in this study, it was necessary to select items from other test batteries, design new methods for recording information, and coordinate these items and procedures into a sequence encompassing motor and speech development, visual and auditory functions, and mental capacities. Every attempt was made to evaluate these behavioral aspects in a manner interesting to the child. The record form used for these items can be seen in Appendix B. The evaluation procedures considered the following five areas:

(A). Generalized motor function: General motor function was evaluated from five major standpoints: dominance, balance, locomotor function (gross motor), manual dexterity (fine motor) and psychomotor problems. This aspect of the evaluation provided additional information to that obtained from pediatric, neurologic, and orthopedic examinations.

(1). Cerebral dominance: Tests of handedness, footedness, or eyedness were used with the examiner recording the preferred side used in three out of five trials. Preferred handedness was determined by having the child pick up small objects placed directly in front of him; footedness by having the child kick an object placed directly in front of him; and preferred eyedness by having the child sight through a tube while focusing on objects in various parts of the room. These procedures were included in the evaluation because evidence of mixed dominance or contra-dominance is often associated with learning problems in children, particularly reading and writing disorders.

(2). Balance: Evaluation of balance included the use of both the Romberg test (feet together; eyes closed; arms extended, with the degree of sway, lateral or forward, recorded) and a rail-walking test, when it was possible for the child to follow directions. This was done in order to observe problems in balance which might suggest cerebelar ataxia, vestibular disorders, and other problems. If a balance problem were suspected, the child was referred for medical confirmation before a problem in balance was recorded.

(3). Locomotor: Evaluation of the locomotor function included a description of gait, stance, speed of movement, range of movement, and/or motor dysfunction (paralysis or paresis). Since gross motor dysfunction is one major key to a possible organic problem, this was also confirmed or rejected as a possible problem by additional medical consultation.

(4). Manual dexterity: This segment of the evaluation included observations of prehension, grasp, pointing, grip, and abilities with paper-pencil tests. Such observations provided evidence for possible developmental or organic problems considered important to the total evaluation.

(5). Psychomotor: Evidence of tremors, asteriognosis, overflow, tics, and extraneous movements were also recorded. Such psychomotor disorders added additional support to the diagnoses of either organic or emotional problems.

(B). Speech Motor Function: The evaluation of the speech motor system included an oral cavity examination, movement of the articulators, and description of speech and voice. Information from the otologist or laryngologist was helpful in this segment of the evaluation.

(1). Oral Cavity: Any deviations of the lips, teeth, palate, jaws, or tongue were noted.

(2). Articulators: The ease and rhythm of the lateral or forward movements of the tongue and the ability to lift the tongue were recorded, indicating whether or not dysarthria or apraxia was present.

(3). Description of Speech: The child was described as having: no speech; delayed speech (at the word, phrase, or sentence level); jargon; echolalia; or an articulation disorder with substitutions, omissions, or distortions of specific sounds. The degree of the articulation problem (mild, moderate, severe) was recorded also.

(4). Description of Voice: The ability of the child to vary the pitch, volume, rate and rhythm of his voice, as well as his ability to sustain tone was recorded.

(C) Visual Motor Function: Some children may have adequate visual acuity and a slight but generalized motor problem, and the integration of visual and motor functions often reveal problems in coordination. Although there are many ways to observe this combined activity, we preferred to observe visual-motor function by using form boards and paper-pencil tests or, for older children, writing performances.

(1). Form Boards: The form boards used in this study were designed by Ferguson (30), and were used to observe the way in which the child handled materials and the time required to complete the performance. If a child was unable to complete the form board considered to be at his chronological age level within a period of five minutes, the item was considered failed. By dividing the performance age by the chronological age, it was possible to obtain an indication of the child's performance level. Particular attention was directed toward the child's behavior if it included: trial and error placement, exclusive use of the left hand during performance, incessant turning of inserts before placement in recesses, need to fit pieces together before placement, need to place all inserts in a line prior to placement, or talking to himself or vocalizing while working. Recognition of an incorrect placement, coupled with inability to make the correction was also recorded. These observations added to the general description of the child's behavior during this part of the evaluation and suggested reasons for failure if the tests were not passed.

(2). Geometric designs: Using paper-pencil reproductions of geometric designs at various age levels (the child imitating the drawing of the examiner) was useful in classifying visual-motor disturbances. In this study we used a gross, unstandardized procedure and were able only to classify the child's performance as passed or failed on the basis of his chronological age expectancy. The procedures used were simple and uncomplicated, consisting of the following geometric designs with assigned expectancy age levels: The circle at two years; the cross at three years; the square at four years; the triangle at five years; the star at six years, and the diamond at seven years. Ability to produce more complex geometric designs was scored seven years plus. Admittedly, this is an extremely gross procedure, but the processes these children used to reproduce such designs were probably more important than the actual completion of the design itself (37). Since the procedure itself was a consistent one, it permitted comparative studies between children with different primary problems.

(3). Draw-a-person: The Draw-A-Person Test (42) is considered both a general test of mental functioning and a visual-motor performance test. This method of evaluation was used during the psychologic evaluation of certain children and was frequently repeated during the language evaluations so that comparisons between the two test situations could be made.

(4). Writing tests: For those older children who had reached the chronological age when they were expected to perform accurately on writing tests, their abilities or disabilities in writing from copy, dictation and/or self-initiation was a valuable source of information. The presence of reversals or inversions in writing, or the general inability to communicate through writing, was taken as supportive evidence for a diagnosis of agraphia.

(D). Auditory Capacities: An evaluation of the auditory capacities of the child usually occurred early in the test sequence, since it was necessary to know whether or not a child was able to receive and respond to auditory stimuli before the responses to tests of other functions could be adequately evaluated. Since hearing evaluations for young children are extremely complex and often tentative, in addition to hearing tests completed by the audiologist which emphasize problems in auditory acuity, the language evaluation included gross evaluations of the ability to localize and discriminate sounds.

(1). Auditory Acuity: The evaluation of auditory acuity has been discussed previously, and the record of this evaluation was available prior to language evaluation.

(2). Localization: Auditory stimuli, in the form of pure tones, social noises, and verbal commands were presented through each of the speakers placed to the front, rear and side of the child being examined. Responses were recorded as follows: ability to differentiate the source of sound in lateral, front, and rear positions; inability to locate the source of sound, but attempted to do so; no attempt to locate the source of sound; appeared to be unaware of sound.

(3). Discrimination: The ability of the child to imitate speech sounds, volume changes, and rhythm changes were recorded. Social noises such as dogs barking, train whistles, and other sounds usually found within the environment, were used to estimate the level of receptive language in the child by requiring him to identify the sound by name, or by pointing to the appropriate picture which indicated the appropriate source of the sound.

(E). Mental Abilities: Actual evaluations of mental abilities were completed by the psychologic consultant as discussed previously. But as part of the language evaluation series, additional information was obtained by using selected test items or adaptations of tests to evaluate certain aspects of language development.

(1). Columbia Mental Maturity Scale: Although former standardization of this scale (18) has been questioned (106), its use in this study was thought to provide a method of determining whether or not a child was able to select similarities and differences-- an important concept in language development. Although this scale was not used to render an evaluation of intelligence per se, it did provide some estimate of the child's ability to recognize and select one picture different from all others in a series.

(2). Ammon's Full Range Vocabulary Test: This test (4) was used to evaluate the receptive vocabulary level of the child and was found to be particularly useful since it did not require speech from the child being examined.

## Staffing and Classification of Subjects

Following the language evaluation sequence, each child was staffed by the participating examiners. Careful and often prolonged staffings were necessary since the evaluation of children's language disorders is a complicated procedure which requires the integration of many seemingly isolated examinations, completed by representatives of various professional disciplines. These sessions included both supportive evidence for including a child in a given category as well as evidence that would exclude from certain categories. All aspects of each examination described were used as a means of placing a child in a given diagnostic category.

The primary classifications used in this study were thought to be consistent with the history of the problem, behavioral symptomatology, and test results. One member of the professional staff assumed primary responsibility for integrating the results of the various examinations. Then, and only then, were recommendations made concerning the total problem. Since service to the individual was considered of equal if not greater importance than the research aspects of this study, the child's abilities as well as disabilities were recorded. Following this, responsibility was assumed for indicating those children who seemingly would benefit from speech or language therapy; specifying the sensory, motor, and mental channels through which the child might receive maximum learning benefits; and suggesting a prognosis for future educational achievement.

We did not assume at any time that the following primary classifications of problems described adequately all facets of the child's performance. But for purposes of clinical classification, seven primary categories were selected and an abbreviation was assigned to each clinical division. These categories are described below. It is suggested that the reader become acquainted with the assigned abbreviations (indicated in parentheses) so that the text that follows can be read more easily.

(A). Language Disorders (L/D):

1. Medical Examination: Evidence or clinical impression of the pediatric consultant that central nervous system involvement was present (either cortical damage or maldevelopment of the cerebrum) and demonstration or clinical impression obtained by psychiatric examination that an emotional disturbance was not the primary problem.

2. Psychologic Examination: Demonstration of reduced mental abilities for communication purposes (.85 or below) but clinical impressions of the psychologist that intellectual potential was normal or near normal.

3. Audiologic Examination: Demonstration by audiologic examination that peripheral auditory acuity loss was not the primary problem.

4. Speech and Language Evaluation: Evidence or clinical impression from language evaluations that the major area of deficiency was the inability to use symbols for communication receptively, expressively or both.

(B). Mental Retardation (M/R):

1. Medical Examination: Evidence of anomalies, endocrine disorders, cerebral damage, familial patterns of mental retardation and/or constitutional inadequacy and demonstration or clinical impression obtained by psychiatric examination that an emotional disturbance was not the primary problem.

2. Psychologic Examination: Demonstration of reduced mental abilities in all learning functions and the clinical impression by the psychologic consultant that mental retardation was the primary problem.

3. Audiologic Examination: Demonstration that peripheral hearing loss was not the primary problem.

4. Language Evaluation: Evidence or clinical impression that the inability to understand communication symbols was an integrated part of general retardation and not due to an inability to understand symbols only.

(C). Hearing Loss (H/L):

1. Medical Examination: Medical evidence to support the diagnosis of hearing loss or clinical impression that hearing loss was the primary problem.

2. Psychologic Examination: Demonstration of adequate mental abilities for communication purposes and normal or

near normal intellectual potential.

3. Audiologic Examination: Demonstration by audiologic examination that hearing loss was the primary problem precluding speech and language development.

4. Language Evaluation: Clinical impression that reception of speech was deficient because of a hearing loss and not due to the child's inability to comprehend verbal symbols.

(D). Emotional Disturbance (E/D):

1. Medical Examination: Evidence from psychiatric and pediatric examinations that emotional disturbance was the primary problem.

2. Psychologic Examination: Demonstration of adequate mental abilities for communication purposes and normal or near normal intellectual potential. Or if child were untestable by routine procedure, then this inability to test was due to emotional disturbance and not other factors.

3. Audiologic Examination: Demonstration or clinical evidence that a hearing loss was not the primary problem.

4. Language Evaluation: Indication that lack of response to verbal stimuli was due to emotional factors and not to an inability to understand verbal symbols.

(E). Immature Behavior (I/B):

1. Medical Examination: Evidence that no apparent medi-

cal problem was present at examination or if a problem did exist, it did not contribute measurably to the delay in speech and language development.

2. Psychologic Examination: Demonstration of normal or near normal intelligence or a clinical impression that intelligence was within normal range.

3. Audiologic Examination: Demonstration or clinical evidence that a hearing loss was not present.

4. Language Evaluation: Demonstration or clinical evidence that a primary problem in the comprehension and use of symbols was not present.

(F). Articulation Disorder (A/D):

1. Medical Examination: Evidence that a physical problem was not the primary causal factor for the articulation disorder.

2. Psychologic Examination: Evidence that neither mental retardation nor emotional disturbance was the primary contributing factor for the dysarticulation.

3. Audiologic Examination: Demonstration or clinical evidence that a hearing loss was not present.

4. Language Evaluation: Evidence that the reception and/or the expression of symbols was adequate for communication purposes.

(G). Not Differentiated (N/D):

The children in the Not Differentiated Group were so classified because of the inability of the examiners to differentiate their problem on the basis of psychologic, medical or language evaluations.

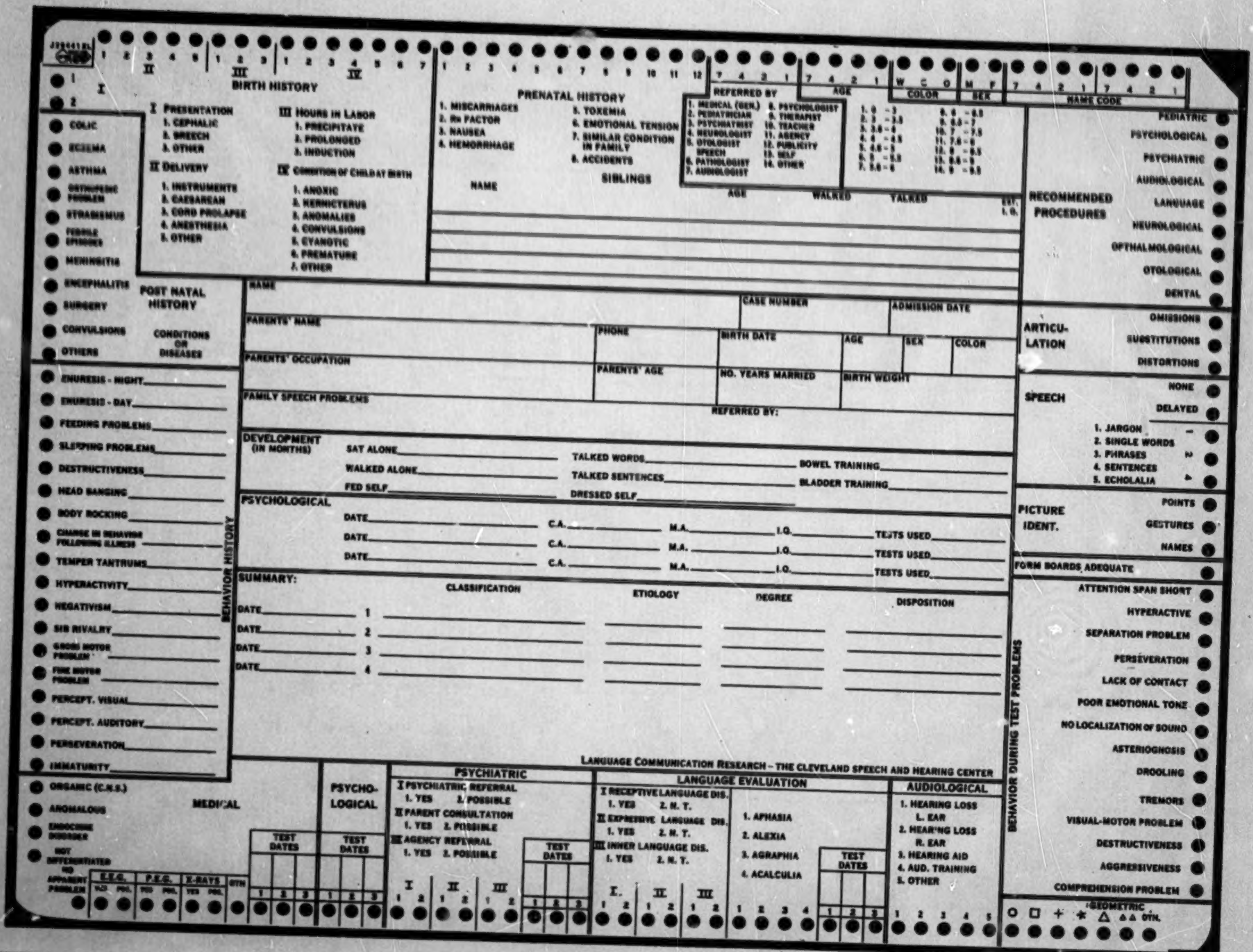
Although hearing loss or emotional disturbance, as primary factors, could be "ruled out" with a fair degree of certainty, the intellectual level, physical status and ability to comprehend verbal symbols could not be differentiated to the satisfaction of the examiners.

## Methods Used to Record and Treat Data

So that the history and test data could be recorded in a systematic manner, a specific form was designed and printed that provided space for: identification items, source of referral, recommended procedures, history and test data and a summary of the problem. This form is reproduced here (See Record Form I) and explained in Appendix C.

The data were treated by procedures which appeared most suitable for the type of data available. These methods included: Pearson Product-Moment correlation, or when variables did not lend themselves to this type of computation, a Tetrachoric or Point Bi-serial correlation: Analysis of Variance; t-tests; Chi-Square; and Bartlett's Homogeneity of Variance test. The Formulae for all of these well-known methods of treat-

# RECORD FORM 1 - HISTORY AND TEST DATA



J3944181
1 2 3 4 5 | 1 2 3 | 1 2 3 4 5 6 7 | 1 2 3 4 5 6 7 8 9 10 11 12 | 7 4 2 1 | 7 4 2 1 | W C O | M F | 7 4 2 1 | 7 4 2 1
I II III IV

**BIRTH HISTORY**

1 2 I

**I PRESENTATION**
1. CEPHALIC
2. BREECH
3. OTHER

**II DELIVERY**
1. INSTRUMENTS
2. CAESAREAN
3. CORD PROLAPSE
4. ANESTHESIA
5. OTHER

**III HOURS IN LABOR**
1. PRECIPITATE
2. PROLONGED
3. INDUCTION

**IV CONDITION OF CHILD AT BIRTH**
1. ANOXIC
2. KERNICTERUS
3. ANOMALIES
4. CONVULSIONS
5. CYANOTIC
6. PREMATURE
7. OTHER

**PRENATAL HISTORY**
1. MISCARRIAGES
2. Rh FACTOR
3. NAUSEA
4. HEMORRHAGE
5. TOXEMIA
6. EMOTIONAL TENSION
7. SIMILAR CONDITION IN FAMILY
8. ACCIDENTS

**REFERRED BY**
1. MEDICAL (GEN.)
2. PEDIATRICIAN
3. PSYCHIATRIST
4. NEUROLOGIST
5. OTOLOGIST
6. SPEECH PATHOLOGIST
7. AUDIOLOGIST
8. PSYCHOLOGIST
9. THERAPIST
10. TEACHER
11. AGENCY
12. PUBLICITY
13. SELF
14. OTHER

**AGE**
1. 0 - 3
2. 3 - 3.5
3. 3.6 - 4
4. 4 - 4.5
5. 4.6 - 5
6. 5 - 5.5
7. 5.6 - 6
8. 6 - 6.5
9. 6.5 - 7
10. 7 - 7.5
11. 7.6 - 8
12. 8 - 8.5
13. 8.6 - 9
14. 9 - 9.5

COLOR SEX NAME CODE

**SIBLINGS**

| NAME | AGE | WALKED | TALKED | EST. I. Q. |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

COLIC
ECZEMA
ASTHMA
ORTHOPEDIC PROBLEM
STRABISMUS
FEBRILE EPISODES
MENINGITIS
ENCEPHALITIS
SURGERY
CONVULSIONS
OTHERS

**POST NATAL HISTORY**
CONDITIONS OR DISEASES

NAME
CASE NUMBER
ADMISSION DATE
PARENTS' NAME
PHONE
BIRTH DATE
AGE
SEX
COLOR
PARENTS' OCCUPATION
PARENTS' AGE
NO. YEARS MARRIED
BIRTH WEIGHT
FAMILY SPEECH PROBLEMS
REFERRED BY:

**DEVELOPMENT (IN MONTHS)**
SAT ALONE____ TALKED WORDS____ BOWEL TRAINING____
WALKED ALONE____ TALKED SENTENCES____ BLADDER TRAINING____
FED SELF____ DRESSED SELF____

**PSYCHOLOGICAL**
DATE____ C.A.____ M.A.____ I.Q.____ TESTS USED____
DATE____ C.A.____ M.A.____ I.Q.____ TESTS USED____
DATE____ C.A.____ M.A.____ I.Q.____ TESTS USED____

**SUMMARY:**

| | | CLASSIFICATION | ETIOLOGY | DEGREE | DISPOSITION |
|---|---|---|---|---|---|
| DATE | 1 | | | | |
| DATE | 2 | | | | |
| DATE | 3 | | | | |
| DATE | 4 | | | | |

**BEHAVIOR HISTORY**
ENURESIS - NIGHT____
ENURESIS - DAY____
FEEDING PROBLEMS____
SLEEPING PROBLEMS____
DESTRUCTIVENESS____
HEAD BANGING____
BODY ROCKING____
CHANGE IN BEHAVIOR FOLLOWING ILLNESS____
TEMPER TANTRUMS____
HYPERACTIVITY____
NEGATIVISM____
SIB RIVALRY____
GROSS MOTOR PROBLEM____
FINE MOTOR PROBLEM____
PERCEPT. VISUAL____
PERCEPT. AUDITORY____
PERSEVERATION____
IMMATURITY____

**RECOMMENDED PROCEDURES**
PEDIATRIC
PSYCHOLOGICAL
PSYCHIATRIC
AUDIOLOGICAL
LANGUAGE
NEUROLOGICAL
OPTHALMOLOGICAL
OTOLOGICAL
DENTAL

**ARTICULATION**
OMISSIONS
SUBSTITUTIONS
DISTORTIONS

**SPEECH**
NONE
DELAYED
1. JARGON 1
2. SINGLE WORDS 2
3. PHRASES
4. SENTENCES 4
5. ECHOLALIA

**PICTURE IDENT.**
POINTS
GESTURES
NAMES

FORM BOARDS ADEQUATE

**BEHAVIOR DURING TEST PROBLEMS**
ATTENTION SPAN SHORT
HYPERACTIVE
SEPARATION PROBLEM
PERSEVERATION
LACK OF CONTACT
POOR EMOTIONAL TONE
NO LOCALIZATION OF SOUND
ASTERIOGNOSIS
DROOLING
TREMORS
VISUAL-MOTOR PROBLEM
DESTRUCTIVENESS
AGGRESSIVENESS
COMPREHENSION PROBLEM

GEOMETRIC
○ □ + ✱ △ △△ OTH.

ORGANIC (C.N.S.)
ANOMALOUS
ENDOCRINE DISORDER
NOT DIFFERENTIATED
NO APPARENT PROBLEM

**MEDICAL**
E.E.G. YES POS.
P.E.G. YES POS.
X-RAYS YES POS.
OTH.
TEST DATES 1 2 3

**PSYCHOLOGICAL**
TEST DATES 1 2 3

LANGUAGE COMMUNICATION RESEARCH - THE CLEVELAND SPEECH AND HEARING CENTER

**PSYCHIATRIC**
I PSYCHIATRIC REFERRAL
1. YES 2. POSSIBLE
II PARENT CONSULTATION
1. YES 2. POSSIBLE
III AGENCY REFERRAL
1. YES 2. POSSIBLE
I 1 2 II 1 2 III 1 2
TEST DATES 1 2 3

**LANGUAGE EVALUATION**
I RECEPTIVE LANGUAGE DIS.
1. YES 2. N. T.
II EXPRESSIVE LANGUAGE DIS.
1. YES 2. N. T.
III INNER LANGUAGE DIS.
1. YES 2. N. T.
I. 1 2 II 1 2 III 1 2
1. APHASIA
2. ALEXIA
3. AGRAPHIA
4. ACALCULIA
1 2 3 4
TEST DATES 1 2 3

**AUDIOLOGICAL**
1. HEARING LOSS L. EAR
2. HEARING LOSS R. EAR
3. HEARING AID
4. AUD. TRAINING
5. OTHER
1 2 3 4 5

ing the data can be found in any standard text on statistical analysis.

## Results*

The total sample population studied consisted of 503 children between the ages of three and nine years who had been referred for examination of their delayed speech and language development. Hereafter, this population will be referred to as the "Total $\overline{503}$ Group".

### Description of the Total $\overline{503}$ Group

As can be seen in Table 4, the Total $\overline{503}$ Group represents a population that was somewhat retarded in all developmental areas and was markedly retarded in the development of speech and language. This significant retardation in language was expected since, as stated previously, these children were referred for diagnosis because of delayed speech and language development. On the average, these children were born of relatively young parents and the children themselves had an average age of about five years. Inspection of the tested I.Q.'s and the estimated potential I.Q.'s indicate that these children were thought, on the average, to be about eight I.Q. points better than they actually tested. The average birth weight of this group was about seven pounds, which is not different from that found in the general population.

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*Because of the numerous tables prepared for this study, all have been assigned to Appendix E to avoid interruption of the text. For ease in locating, Appendix E is on white paper.

A little over 12 per cent of the population was Negro. The sex ratio was approximately 2:1 in favor of the males, and this corresponds with other general findings that there is a higher incidence of mental retardation, birth problems, and all handicapping conditions in males than in females. The Socio-economic status of the parents of this group was distributed about the way it is in the general population. The distribution of race, sex, and Socio-economic status for this population can be seen in Table 5.

Prenatal History Items: The prenatal history items for this study included information concerning the following: miscarriages, Rh incompatibility, nausea, hemorrhage, toxemia, emotional tension in the mother during pregnancy, incidence of similar problems in siblings, accidents involving the mother during pregnancy and "other" problems that were considered possible causal factors in the prenatal history.

The incidence of prenatal history items are displayed in Table 6. As can been in that table, possible prenatal problems occurred in a little over half of the total population. Miscarriages were reported in almost 20 per cent of the prenatal histories of these children, and hemorrhage in approximately 12 per cent. Nausea, which was recorded only when severe (i.e., occurring throughout the pregnancy period) was reported in approximately 11 per cent of the population; Rh incompatibility, in approximately nine per cent; emotional tension in the mother (also recorded only when a severe problem existed) was present in approximately seven per cent. A little over four per cent of the mothers had been involved in accidents during pregnancy with the child under study, and approximately four per cent reported "other" problems. Toxemia, reported in only 12 mothers, or a little over two per cent, may be due to the fact that the mothers were not always aware of this problem when it existed nor was this problem always clearly indicated in medical records.

Birth and Neonatal History: The birth and neonatal history items consisted of the following: methods of presentation (cephalic, breech, Caesarian section); use of instruments during the birth process; cord prolapse; use of anaesthia; "other" delivery problems; precipitate labor; prolonged labor; induced labor; anoxia; kernicterus; anomalies; convulsions; cyanosis; prematurity; and postmaturity.

Almost 90 per cent of the Total $\overline{503}$ Group presented cephalically while the remaining 10 per cent were divided almost equally between breech and Caesarian. It is interesting to note that instruments were needed as an aid to delivery in only a little over 12 per cent of the total population. (It should be emphasized that instruments are not considered causal factors of damage at birth but rather that the need to use instruments during the birth process suggests that a child is already in the state of difficult delivery, necessitating the use of instruments to prevent additional problems.) Anaesthia was used in more than 64 per cent of the total population, but cord prolapse occurred in only a little over one per cent. Another interesting point was the incidence of nearly 21 per cent "other" delivery problems which, in our records, referred almost exclusively to the child being "held back" at the time of delivery. Incidence of precipitate labor (three hours or less) occurred in almost nine per cent of the population and the incidence of prolonged labor (18 hours or more) was approximately the same. Induced labor was reported in a little less than eight per cent of the mothers.

Lack of oxygen at birth is often considered one of the major contributing factors to organic problems. In this population over 12 per cent had anoxia; over four per cent had kernicterus; and almost six per cent were cyanotic. Anomalies were present in more than eight per cent of the total population; convulsions occurred in more than three per cent. Prematurity (five pounds or less) was reported in more than six and one half per cent, while postmaturity (9.5 or more) was reported in a little more than three per cent. This information is reported in Table 7.

It was not possible to make accurate comparisons of the incidence of these birth and neonatal history items with expectations in the general population. However, since all of these items, with the exception of cephalic presentation, are considered supportive evidence for later problems, it is sufficient perhaps to report the incidence of these problems as a background description of the Total $\overline{503}$ Group.

Postnatal History Items: The postnatal history items consisted of: colic, eczema, asthma, orthopedic problems, strabismus, febrile episodes, meningitis, encephalitis, surgery (other than routine such as tonsillectomy), convulsions, and problems "other" than those listed. Table 8 shows the distribution of these dichotomous variables in the Total 503 Group. Febrile episodes occurred with the highest incidence of any of the postnatal history items, and were present in more than 24 per cent of the total population. However, specific diseases such as meningitis and encephalitis both occurred in less than one per cent of the population. (Our medical consultant pointed out that both meningitis and encephalitis may go undiagnosed at the time of onset and that perhaps the incidence of such diseases is, in fact, considerably higher.) Colic, considered by some an indication of an organic problem and by others as indication of emotional disturbance, occurred in almost seven per cent of the total population. Eczema and asthma, usually coupled with emotional problems, occurred in almost four per cent and a little over two per cent respectively, while orthopedic problems and strabismus, usually related to organic factors, occurred in over three per cent and almost seven per cent respectively. Surgery, which required more than routine hospitalization, was reported in almost 20 per cent of the cases studied. Although the type of surgery required is an important factor in the history of a child, the period of time the child is separated from his family and in a strange hospital environment is also an important factor here. Convulsions, often considered a positive landmark in the diagnosis of an organic problem, were present in approximately 10 per cent of this population. Other postnatal problems, not listed separately, occurred in almost eight per cent of the Total $\overline{503}$ Group.

Medical Diagnoses: As discussed previously, each child in the Total $\overline{503}$ Group was examined by the medical consultant and classified in one of five categories: organicity, anomalies, endocrine disorders, undifferentiated problem and no apparent problem. Definitions of these categories can be found in Appendix C. Table 9 shows the distribution of medical diagnoses in the Total $\overline{503}$ Group. Organicity or central nervous system involvment, was present in more than 42 per cent of this population. Only six per cent were found to have anomalies; and only one child was found to have an endocrine disorder. Less than 13 per cent had no apparent medical problems. However, undifferentiated medical problems were found in almost 40 per cent of this population, indicating that although the medical consultant was convinced on the basis of his clinical judgment that some medical problem was probably present, a specific diagnosis could not be made without additional laboratory tests. Attempts were made later to differentiate those medical problems by referring the child to his own family physician or pediatrician for further study. This fact points up, additionally, that this population was heavily infiltrated with children whose problems were not "clear-cut" and supports further the need for intensive study of such a group.

Behavior Problems Reported by Parents: These behavior problems consisted of the following variables: enuresis (night), enuresis (day), feeding problems, sleeping problems, destructiveness, head banging, body rocking, behavior change following illness, temper tantrums, hyperactivity, negativism, sibling rivalry, motor problem (gross), motor problem (fine), perseveration, and immaturity. The incidence of these variables in the Total 503 Group can be found in Table 10.

Nocturnal enuresis was reported in a little over 12 per cent of this total population while enuresis during the day was reported in only a little over three per cent. Feeding problems and sleeping problems were reported in more than seven per cent and more than five per cent respectively. Destructiveness was reported in almost eight per cent while other behavior problems that are sometimes associated with destructiveness, such as head banging and body rocking, were reported in a little over six per cent and considerably more than nine per cent respectively. Behavior problems often associated with emotional disturbance were reported with comparatively high incidence: temper tantrums were found in more than 17 per cent; negativism in more than 11 per cent; and sibling rivalry in a little more than eight per cent. Behavior changes following illness were reported in almost three per cent of the total population. Other problems, those usually associated with organic disorders, were reported with higher incidence than any other type of behavior problem. For example, hyperactivity was reported in almost 27 per cent; gross motor problems in more than 22 per cent; and fine motor problems in more than 23 per cent. Perseveration was reported in less than one per cent, but this low incidence is believed to be due to the fact that the parents were not thoroughly cognizant of the meaning of the term "perseveration". However, parents are seemingly more clearly aware of the term "immaturity". and they reported that more than 18 per cent of these children had immature behavior.

Behavior Problems Reported by Examiners: The following behavior problems and their incidence were recorded by examiners during the evaluation of each child: short attention span, hyperactivity, separation problem, perseveration, lack of contact with the environment, poor emotional tone, inability to localize the source of sound, asteriognosis, drooling, tremors, visual-motor problems, destructiveness, aggressiveness, and comprehension problems. It is interesting to note that, although the parents reported that more than 27 per cent of the total group were hyperactive, the examiners reported only 22 per cent. Also, the parents reported almost eight per cent of these children were destructive while the examiners reported less than three per cent had this behavior problem. Both of these differences could be accounted for by the control of hyperactivity and destructiveness that is maintained during evaluation, a control which may not be possible in the home environment. It is equally interesting to note that although the parents reported less than one per cent of these children were perseverative in their behavior, the examiners reported almost seven per cent had a problem in perseveration. As discussed previously, this discrepancy is probably due to the fact that the parents did not recognize perseverative behavior when it occurred.

Table 11, displays the incidence of behavior problems as reported by the examiners, showing that 32 per cent of these children had a short attention span during testing; more than 11 per cent had a severe problem in separating from their parents; and more than nine per cent were found to be out of contact with their environment at some time during the testing procedures. More than 10 per cent were considered to have poor emotional tone, which meant that these children did not relate to others in their environment in an appropriate emotional manner. Almost 28 per cent of the Total $\overline{503}$ Group were unable to localize the source of sound; 24 per cent were found to have asteriognosis; almost 10 per cent drooled and more than 34 per cent showed evidence of tremors. Visual-motor problems were found in more than 35 per cent and more than 60 per cent had comprehension problems. Comparatively few (approximately three per cent) were classified as aggressive. All of these behavioral problems are defined and discussed in Appendix C.

*Objective Test Results:* Using objective test measures consisting of form boards, geometric designs and picture identification, it was found that only a little less than 30 per cent were able to perform adequately on the Form Board Test. Similarly, only 24 per cent were able to pass the Geometric Design Test. In the Picture Identification Test, more than 48 per cent of this population were unable to identify pictures by pointing, gesturing, or naming. Table 12, shows the distribution of *passed* or *failed* items for the Total $\overline{503}$ Group. Briefly, between 70 and 75 per cent were unable to perform adequately on the Form Board Test or the Geometric Design Test and almost 49 per cent were unable to identify pictures in any way.

Speech Classification: The speech level of the Total $\overline{503}$ Group is shown in Table 13. Of the total population, more than 17 per cent had no speech at the time of examination. Almost 43 per cent were classified as having delayed speech development. Of this delayed speech group, 36 per cent were delayed at the single word level; almost 45 per cent were delayed at the phrase level; 19 per cent were delayed at the sentence level. Of the total population, more than six per cent were found to use jargon instead of speech and more than four per cent were echolalic. Articulation disorders were found in almost 28 per cent of the population, which consisted of almost 28 per cent errors in omission of sounds; 80 per cent substitution of sounds, and almost 28 per cent distortion of sounds. Since any child may have had more than one type of articulation disorder, these percentages were not mutually exclusive, and are mentioned here only to describe more completely the type of articulation disorders present in the total group. There were also four children, or less than one per cent of the total group, who had no speech problems, but who had been referred for examination of reading problems (alexia) only.

## Combined Dichotomous Variables for the Total $\overline{503}$ Group

In order to see more clearly the types of patterns that might be present in the Total $\overline{503}$ Group in terms of the dichotomous variables just discussed, certain variables were combined. Prenatal History items combined the incidence of: miscarriages, Rh incompatibility, nausea, hemorrhage, toxemia, emotional tension in the mother, similar problems in siblings, maternal accidents, and other prenatal problems. By combining these variables, it was found that the Total $\overline{503}$ Group had more than a 50 per cent incidence of prenatal history problems. By combining Presentation Problems (Caesarian and breech deliveries) it was found that somewhat more than 10 per cent of this population had abnormal birth presentations. The Neonatal History items (combining the incidence of kernicterus, anomalies, and convulsions) showed that almost 16 per cent of the Total $\overline{503}$ Group had neonatal history problems. Combined Delivery History items consisted of instruments used, cord prolapse, anaesthesia, "other" delivery problems, precipitate labor, prolonged labor, induced labor, anoxia, cyanosis, prematurity, and postmaturity; almost 92 per cent of this population had one or more of these paranatal problems.

History Items Reported by Parents, were combined also into: postnatal problems, possible organic problems, high temperature diseases, and surgery. The postnatal problems consisting of colic, eczema, and asthma showed a combined incidence of more than 11 per cent; possible organic problems composed of orthopedic problems, strabismus, and convulsions, were found in almost 19 per cent; and high temperature diseases including encephalitis, meningitis, and febrile episodes, showed a combined incidence of more than 25 per cent. Surgery, as reported previously, was found in more than 19 per cent of the population. Medical diagnoses of problems such as: organicity, anomalies, endocrine disorders, and not differentiated problems, were found in more than 87 per cent of the Total $\overline{503}$ Group.

Behavior variables including: nocturnal enuresis, daytime enuresis, feeding problems, sleeping problems, destructiveness, temper tantrums, sibling rivalry, negativism, and immaturity were combined into one group classified as Possible Psychoneurotic Behavior, and it was found that more than 51 per cent of the total population had problems of this type. Possible Psychomotor Disturbance -(head banging and body rocking)- was found in almost 12 per cent; and Possible Organic Behavior -(behavior change following illness, hyperactivity, gross and fine motor problems, perseveration)- were found in almost 53 per cent of the total group studied. Table 14 shows the distribution of these combined variables.

## The Seven Diagnostic Categories of the Total $\overline{503}$ Group

The Total $\overline{503}$ Group was then sorted into seven primary diagnostic categories so that comparisons could be made in terms of history items and test results. A description of each of these seven categories has been given previously (pp. 46-50), and relisted below with an assigned abbreviation in parenthesis so that they can be discussed in the text and tables with greater brevity. As can be seen in Table 15, the diagnostic categories of the Total $\overline{503}$ Group consisted of: Language Disorders (L/D); Emotional Disturbance (E/D); Mental Retardation (M/R); Hearing Loss (H/L); Articulation Disorders (A/D); Immature Behavior (I/B); Not Differentiated (N/D). When the Total $\overline{503}$ Group was broken down into these categories, it consisted of approximately 1/3 Language Disorders and about 1/5 each of Emotional Disturbance and Mental Retardation. The other categories (Hearing Loss, Articulation Disorders, Immature Behavior, and Not Differentiated) were comparatively small, ranging from five and one half per cent to nine per cent.

Locomotion Variables: Comparison of locomotion variables (sitting and walking alone) among the seven diagnostic categories is shown in Table 16. A significance* test was not done on the data for sitting alone, since by inspection the means for these seven groups were not greatly different. In general, the M/R group achieved sitting alone at a later time (8.1 months) and the I/B group at an earlier time (5.9 months) than any of the other groups. Both the L/D and the N/D groups were somewhat later (approximately seven months) in sitting alone than all other groups, with the exception of those children who were mentally retarded. Since the N/D group probably consisted of children with mental retardation or language disorders, it is not surprising that they were more like those two groups than any of the others.

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*The generally accepted .05 confidence level was used in this study as the level for rejecting the null hypothesis.

The I/B group walked alone earlier than any other group (approximately 12 months) followed closely by the A/D group (12.7 months). Next was the E/D group (13.1 months) and the H/L group (13.6 months). The L/D group (14.1 months) and the N/D group (14.3 months) were again quite similar. The M/R group showed the most severe delay in walking (17.1 months) which is not different from expectancy. The significant differences in standard deviations for the seven diagnostic categories in the age of walking alone might be accounted for in the M/R group by the variability in the degree of mental retardation, while the variability in the H/L group might depend upon whether or not vestibular problems were present. The greater variability in the L/D group and the N/D group might be accounted for by the fact that many of the problems in both groups had organic etiologies.

Speech Variables: Table 17 shows the comparison of the seven diagnostic groups on speech variables. Children with articulation problems had the earliest onset of both words (21 months) and sentences (31.8 months). The I/B group was next with both words (25 months) and sentences (33 months) appearing earlier than the remaining groups with the exception of the E/D group with words (25.5 months) and sentences (35 months). Children in the L/D and the N/D groups began to talk words and sentences at approximately the same time (L/D: words at 28 months, sentences at more than 38 months; N/D: words at almost 30 months, sentences at 38 months). As expected, the M/R group and the H/L group had the latest onset of both words and sentences, exceeding the L/D group by about four months in words and six and nine months respectively in sentences.

There was much more variability in talking words than in talking sentences, possibly owing to the fact that once words are achieved sentences tend to develop more reliably regardless of the type of problem. This great variability in the onset of words is expected, particularly in such problems as mental retardation or hearing loss where the divergence is presumably the result of the variability in the degree of mental retardation and hearing loss. The greatest difference between the onset of words and the acquisition of sentences occurred in the H/L group (approximately 15 months, on the average) followed by the M/R group (approximately 13 months, on the average) and then the L/D group (approximately 11 months). The time lag between words and sentences for the E/D group and the A/D group was about 10 months while the I/B and N/D groups had a difference of only eight months. The marked lag in the onset of sentences after the onset or words, particularly in the H/L group, relates to the fact that without adequate hearing it is difficult tc understand the sequence of words in a sentence even though individual words may be understood with comparative ease. Similar reasoning with problems such as mental retardation and language disorders might apply here.

Self Help Variables: In self help items, including bowel and bladder training, feeding self and dressing self, the seven groups were, on the average, approximately the same with the exception of the M/R group, which was considerably delayed in all four areas. Table 18 shows this distribution.

Age and Birth Weight Variables: There is not anything remarkable about the difference in ages among the parents of the seven groups. In the child's age, it is probably noteworthy that the emotionally disturbed children were younger, on the average, and this is probably due to the fact that children with marked behavior problems tend to be referred to clinics at an earlier age than do children with other problems. The same reasoning might be applied to the N/D group, who also had behavior problems. The I/B group were younger in age, on the average, by definition.

There was nothing remarkable about the birth weights for the seven groups. All were within normal range and none, on the average, deviated more than one-half pound. This information concerning the ages of the parents and children, and the birth weights for the seven groups can be seen in Table 19.

Tested I.Q.'s: In terms of tested I.Q., four of the groups were, on the average, within normal range, the exceptions being children with language disorders, those with mental retardation, and those problems that were undifferentiated. The low mean I.Q. of the M/R group was expected by definition and the low I.Q. mean of the L/D group was probably related to difficulties encountered in testing these children. The N/D group, as previously stated, probably was a mixture of several problems, including mental retardation. However, it is noteworthy that while the L/D group had a normal estimated potential I.Q., the M/R group was virtually no different whether the I. Q. was tested or estimated. This was largely true of the other groups with the exception of the N/D group, which showed an increase of about 10 points, suggesting that the N/D group and the L/D group were similar in terms of difference between tested and estimated I.Q.

The homogeneity of the groups with respect to I.Q. varied considerably and to a significant degree, as indicated by the Bartlett's test. The I/B group was the most compact and the H/L group the most divergent. The considerable variability in the E/D group, many of whom may have been pseudo-retarded, and in the L/D group, many of whom showed lowered test scores because of communication difficulty, was expected.

Estimated I.Q.: It is of interest to note here that there was less variability when I.Q.'s were estimated than when tested. This is true in all cases except the M/R group, where the variability was the same for both. The discrepancy in variability in the I/B, H/L, and N/D groups was not remarkable owing to the small numbers. These data are displayed in Table 20.

### Comparison of Single Dichotomous Variables
### Among the Seven Diagnostic Categories of the
### Total $\overline{503}$ Group

Socio-economic Level: Table 21 displays the socio-economic breakdown for the seven diagnostic categories of the Total $\overline{503}$ Group. As can be seen by inspection, there were not any marked differences when the socio-economic groups were compared. It is, therefore, sufficient to say that the socio-economic levels of the parents were distributed randomly throughout the population regardless of the classification of the problem.

Race and Sex: Table 22 shows the comparison of race and sex among the seven diagnostic categories of the Total $\overline{503}$ Group. Negroes were distributed randomly among the various diagnostic categories. Sex, however, differed markedly from group to group and to a significant degree. Males were especially predominant in the L/D group and in the I/B group. This may be related to the fact that males are slower to develop and, according to other studies, more predisposed toward cerebral damage or cerebral malfunction. This significant difference in sex was also true, but to a lesser degree, in the M/R, E/D and N/D groups. Although more males are usually found in all handicapped populations, the fact that more than 76% of the L/D population were males, was still an impressive difference.

Prenatal Problems: When comparing the prenatal problems among the seven diagnostic categories, it was found that the seven groups cannot be differentiated in terms of the following Prenatal Problems: miscarriages, Rh incompatibility, nausea, hemorrhage, toxemia, emotional problems in the mother, similar familial prenatal problems, maternal accidents during pregnancy, or "other" problems. This lack of difference was probably due to the fact that all of these factors are possible causes for the types of problems found in this total population. It may be important, however, to point out the small N's in toxemia, similar familial problems, maternal accidents, and "other" problems. Apparently, these problems were not common in this population. This information is reported in Table 23.

Birth Problems: Table 24, compares the Birth Problems among the seven diagnostic categories, problems which included difficulties in presentation, labor, and delivery. In general, the N's were small in presentation and labor problems and significance tests could not be calculated. Delivery problems such as Caesarian section or cord around the neck occurred infrequently and also could not be considered. Anaesthesia was common but could not be used as a basis for differentiation among the groups. Use of instruments was significantly higher in the L/D, E/D, I/B, and N/D groups, but the latter two groups had very small N's. It is worthy of comment that the E/D group had as high an incidence of instruments as the L/D group. Again, it should not be inferred that the use of instruments in delivery for this population was considered a causal factor, in and of itself, but rather that a possible problem probably existed prior to the child's delivery which necessitated the use of instruments. The incidence of "other" problems (almost exclusively reports of "holding back head of child at time of delivery" for this population) was significantly higher in the L/D, M/R, E/D, and H/L groups than was found in the I/B group. The A/D and the N/D groups had relatively no report of these "other" delivery problems. Although this lack of incidence would be expected for the A/D group, it was not expected in the N/D group. It is possible perhaps that one of the reasons for the examiners' inability to differentiate the N/D group was this lack of causal factors, as reported, in the birth history.

A comparison of other Birth Problems (anoxia, kernicterus, anomalies, convulsions, cyanosis, prematurity, and postmaturity) for the seven diagnostic categories of the Total 503 Group is reported in Table 25. The incidence of convulsions and "other" conditions was relatively small and significance tests were not done. The incidence was higher in cyanosis, prematurity, and kernicterus, but no significant differences among the seven groups were found. With anomalies, however, there was a significantly higher incidence in the M/R and the N/D groups. This may have resulted from the presence of mental retardation in the N/D group and is, therefore, according to expectancy. The incidence of anoxia was markedly heavier in the L/D group (more than 1/4) but in the H/L, A/D and the N/D groups there was none reported. The M/R, E/D, and I/B groups ranged from four to ten per cent in anoxia incidence. This same distribution was also found when all problems likely to be related to anoxia were combined (anoxia, kernicterus, cyanosis). The per cent of anoxia was four times greater in the L/D group than in the M/R group, and twice as great in the L/D group when compared with the E/D group. However, it was of great interest that over 20 per cent of the E/D group has anoxia, supporting other studies which have suggested that brain damage may be one factor contributing to emotional disturbance. No other significant differences among the seven categories were found in this comparison (See Table 26).

Postnatal Problems: Table 27 shows the comparison of the Postnatal Problems among the seven diagnostic categories. These Postnatal Problems consisted of: colic, eczema, asthma, orthopedic problems, strabismus, febrile episodes, meningitis, encephalitis, surgery, convulsions, and "other" problems. In this comparison, meningitis, encephalitis, asthma, eczema, orthopedic problems, and "other" problems did not occur with sufficient frequency to allow significance tests. Although Chi-squares were done on colic, febrile episodes, strabismus and surgery, none were significant. However, the incidence of convulsions was significantly higher in the L/D, M/R, and possibly the A/D groups. Although this difference might be expected in the L/D and M/R groups, it would not be expected generally in the A/D group.

Medical Diagnoses: As can be seen in Table 28, the comparison of the Medical Diagnoses among the seven diagnostic categories showed that organicity (central nervous system involvement) did not occur to any great extent in the I/B or A/D groups, suggesting that the tendency toward a higher incidence of convulsions in the A/D group discussed above was not related apparently to an equally high incidence of organicity. Yet, organic problems were somewhat higher in the E/D and N/D groups and occurred in a little over one-fourth in the H/L group. Organicity was markedly higher in the M/R group (2/5) and very high (4/5) in the L/D group. This latter difference was of particular importance, and supported the relationship between language disorders and central nervous system involvement. On the other hand, anomalies were practically nonexistent in all groups with the exception of the M/R and the N/D groups, and this was according to expectancy, since anomalies are usually identified with mental retardation.

There were more "undifferentiated" medical diagnoses in all other groups than in the L/D group. This was probably due to the fact that the pediatric consultant for this study was particularly skilled in the identification of organic problems which is the primary causal factor for language disorders. But this physician was also aware that physical problems existed in some of the children in the other groups even though the specific type of problem could not be clearly differentiated at the time. Rather than state that "no problem" existed for those children where physical disorders were suspected but not classifiable, the category "undifferentiated" was used.

Behavior Problems Reported by Parents: Table 29 shows the comparison of the behavior problems as reported by parents for the seven diagnostic categories. These problems included: enuresis (night), enuresis (day), feeding problems, sleeping problems, destructiveness, temper tantrums, negativism, sibling rivalry, and immaturity. Daytime enuresis did not occur frequently enough to investigate the relative incidence. Feeding problems occurred more frequently but the incidence was not significantly different among the seven diagnostic categories. However, nocturnal enuresis differed significantly when the M/R, E/D, and N/D groups were compared with all other groups. This was according to expectancy since enuresis is usually associated with mental retardation or emotional disturbance. Sleeping problems, as expected, occurred significantly more often in the E/D group than any other group; destructiveness was significantly higher in the E/D and to a degree in the H/L groups. In this situation, a child with an undiagnosed hearing loss (for some of these children this problem had remained undiagnosed for considerable time) would be justifiably aggressive in behavior, while destructiveness might be expected in the children with emotional disturbance. Temper tantrums differed significantly among the groups with an incidence of nearly 1/3 in the E/D group, which could be expected. About 1/5 of each of the L/D and H/L groups also had temper tantrums which might be expected because of the frustration inherent in these problems when not differentiated; M/R and N/D groups had temper tantrums reported in only a little over ten per cent. The highest incidence of negativism was in the H/L (1/4) and the E/D (1/5) groups. This did not seem to be an unusual finding. Sibling rivalry, as expected, occurred in 25 per cent of the E/D group but to a negligible degree in all other groups. Immaturity was reported more frequently in the I/B group, which suggested that this term and the type of behavior associated with this classification, was more clearly understood by the parents than perhaps some other clinical terms.

Comparisons of behavior problems that could be considered psychomotor or organic behavior, as reported by the parents, is contained in Table 30. These behavior problems consisted of the following: head banging, body rocking, behavior changes following illness, hyperactivity, gross motor problems, fine motor problems, and perseveration.

Head banging did not differentiate itself among the seven groups but body rocking occurred significantly more frequently in the M/R, E/D and H/L groups. Reports of behavior changes following illness and perseverative behavior were relatively infrequent and significance tests were not done. Hyperactivity, however, was relatively frequent but did not occur in the I/B or the A/D groups; it was found in about 1/3 of the M/R, E/D, and H/L groups; in over 1/4 of the L/D group; and in about 1/5 of the N/D group. In short, hyperactivity occurred, as expected, where there was a majority of organic problems. Motor problems, both gross and fine, were confined largely to the L/D and the M/R groups, although fine motor problems occurred more frequently than gross in the H/L, A/D, and N/D groups.

Table 31 shows the comparison among the diagnostic categories of the Total $\overline{503}$ Group for behavior problems and test responses reported by examiners. The items included in this table were: short attention span, hyperactivity, separation problem, perseveration, lack of contact, poor emotional tone, drooling, tremors, destructiveness, aggressiveness, no localization of sound, asteriognosis, visual motor problems, and comprehension problems.

Destructiveness and aggressiveness did not occur with sufficient frequency to allow for significance tests. Hyperactivity, separation problems, perseveration, lack of contact, and drooling were tested for, but did not reach significance levels. Short attention span and tremors both occurred most frequently in the L/D and M/R groups and to a lesser degree in the N/D group. Their occurrence was negligible in the A/D group. Poor emotional tone was confined largely to the E/D (1/4) and to a lesser degree to the M/R group, which could be expected.

It is interesting to note that 2/3 of the L/D group could not localize the source of sound; the incidence was less than 10 per cent in other groups with the exception of the H/L group (1/5). The inability to localize the source of sound in the H/L group could be accounted for on the basis of auditory imperception or unilateral loss. In the L/D group, however, there were more problems of auditory imperception or a greater tendency to exclude auditory stimuli. Nearly 1/2 of the L/D group had asteriognosis, while only 1/5 of the M/R and I/B groups had this problem. There was no asteriognosis reported in the E/D or H/L groups but about 10 per cent of the A/D group and a little less than 10 per cent of the N/D group showed evidence of asteriognosis. This supports the theory that asteriognosis is closely identified with organic problems. Visual motor problems occurred relatively infrequently in the E/D, I/B, and A/D groups. Such problems occurred in about 1/5 of the H/L group, in about 1/4 of the N/D group, and in 2/5 of the M/R group. However, 62 per cent of the L/D group had visual motor problems, which again indicates that such problems are closely related to organicity. Comprehension problems were negligible in the A/D group and relatively infrequent in the I/B group. However, 2/5 of the E/D group and nearly 1/2 of the N/D group had comprehension problems, which is according to expectancy. Also as expected, 80 per cent of the L/D group had comprehension problems, which suggests that the majority of these children with language disorders had problems in the reception of speech symbols, while relatively few had primary expression problems.

Objective Test Items: The comparison of the objective test items among the seven diagnostic categories of the Total $\overline{503}$ Group included results from tests using form boards, geometric designs and picture identification cards. These results are probably most interestingly viewed as comparative items, the geometric design test being a two dimensional task, and the form boards a three dimensional. The L/D, M/R, and the N/D groups were all significantly less adequate in both of these tests than were the other groups. This again points up the obvious factor of organicity. The E/D group, to a lesser degree than the other three groups, also performed inadequately to a significant degree on these two tests but this was probably due to their refusal to perform rather than a lack of ability. The H/L group performed more adequately on geometric designs than on form boards, suggesting, at least in part, some degree of organicity. However, the I/B group performed significantly better on geometric designs than on form boards, and this is probably related to a developmental factor. The most interesting aspect of this table, (Table 32), is that the articulation group performed significantly better on form boards than geometric designs. Since geometric designs reqeire eye-hand coordination, it is postulated that the type of visual perceptual disorder often associated with reading disorders may also be present in children with articulation disorders so that they may be found to have reading disorders as well as speech disorders.

With reference to picture identification, gesturing occurred in only a few instances, and pointing was randomly distributed among the groups. All of the A/D group identified pictures by naming, whereas only a few of the H/L group could name the pictures. About 1/4 of the N/D group, 1/3 of the E/D group, nearly 40 per cent of the L/D group, and

20 per cent of the M/R group could identify pictures by name. Conversely, almost 1/2 of the L/D group, 1/2 of the E/D group, about 2/3 of the M/R group, and well over 1/2 of the N/D group were unable to identify pictures at all. As expected, because this is a verbal item, nearly 3/4 of the H/L group could not perform on this test.

Speech Development Level: Table 33 shows the comparison of the speech developmental levels among the seven diagnostic categories of the Total $\overline{503}$ Group. As was expected, about 1/2 of the H/L group and 1/4 of the M/R group had no speech. The other groups, including the L/D, E/D, and N/D groups, had about 15 per cent who did not use speech. The incidence of no speech in the I/B and A/D groups was negligible. However, nearly all of the I/B group had delayed speech and approximately 1/2 of the other groups were delayed in speech. In general, the I/B group was delayed less at the word level than other groups, and the E/D group and the L/D group were delayed more at the sentence level. Both jargon and echolalia were randomly distributed among the seven groups.

Articulation Problems: Comparison of the type of articulation disorders found among the seven categories of the Total $\overline{503}$ Group is reported in Table 34. Although there was a significant difference in the incidence of articulation disorders among the groups (10 per cent in M/R, 14 per cent in N/D, 28 per cent in L/D, 35 per cent in E/D), there were no significant differences in the types of disorders and omissions, substitutions, and distortions were randomly distributed. By definition, the

H/L, A/D, and I/B groups had a high incidence of articulation disorders and were not compared.

### Comparison of the Combined Dichotomous Variables Among the Seven Diagnostic Categories

As discussed previously (Table 14) the dichotomous variables were combined into groups consisting of prenatal history items, birth presentation history items, neonatal history items, delivery history items, history items reported by parents, medical diagnoses, and behavior problems reported by parents. Using these same combinations, the seven diagnostic categories of the Total $\overline{503}$ Group were compared. Table 35 shows the results of these comparisons for the seven diagnostic categories. Items combined in the prenatal history, birth presentation problems, delivery history items, postnatal history items, high temperature diseases, and surgery problems, were all randomly distributed among these seven groups. Neonatal problems (kernicterus, anomalies, and convulsions) were more frequently found in the M/R group (about 1/4) and somewhat less in the other groups. The incidence of neonatal problems in the I/B and A/D groups was negative. The "possible organic" history items were found more frequently in the L/D and M/R groups (about 1/4 each) and less so in the A/D and the N/D groups. They occurred relatively infrequently in other groups. Nearly all of the L/D and M/R groups had medical history problems and these problems were present also in over 80 per cent of the

E/D, H/L and N/D groups. Well over 1/2 of the I/B and A/D groups had such problems, showing a relatively high incidence of this type of problem in the total population under study.

Possible psychoneurotic behavior (enuresis, both day and night, eating problems, sleeping problems, destructiveness, temper tantrums, sibling rivalry, immaturity, and negativism) occurred, as expected, in about 3/4 of the E/D group and approximately 1/2 of the L/D, M/R, I/B, H/L and N/D groups. Only the articulation problems were relatively free from these behavior problems, suggesting that organic disorders, which are present in some of these groups, including the E/D group, tend to invite a superimposed emotional problem.

Possible psychomotor disturbances (head banging or body rocking) were present in about 1/2 of the M/R and E/D groups and to a lesser degree in the L/D and H/L groups. Other groups were relatively free from these behavior disorders. Possible organic behavior (behavior change following illness, hyperactivity, gross motor problems, fine motor problems, and perseveration) were present in nearly 3/4 of the L/D group and nearly 2/3 of the M/R group. This type of behavior also occurred in about 1/2 of the E/D and H/L groups. However, they were present also in about 1/5 of the A/D and N/D groups, leaving only the I/B group relatively free from what is considered here to be "possible organic behavior".

## Comparison of "Pure" and "Mixed" Sub-groups of the Seven Diagnostic Categories

However, this breakdown of the Total $\overline{503}$ Group into seven diagnostic categories did not result in seven "pure" categories, but rather seven categories which were predominately one problem or another, with several mixed problems included. Therefore, for purposes of comparison it was necessary to overlook some of the mixtures that were present in each of the diagnostic categories or groups and to classify those problems that were considered "very nearly pure" as "pure" sub-groups, while others within a given category were considered "mixed" sub-groups. These divisions are acceptable only as long as the reader remembers that "pure" sub-groups within the seven diagnostic categories are not actually "pure" but only "approximately pure".

Table 36 gives the relative incidence of the "pure" vs "mixed" problems in each of the seven diagnostic categories or groups. Only 1/3 of the language problems were considered "pure" by definition, but nearly 3/4 of the mentally retarded children were classified in this way, and nearly all (90 per cent) of the emotionally disturbed group. There was also a high incidence of "mixed" problems in the hearing loss group, which might suggest that organic etiologies could be linked with a larger portion of auditory deficiency in this group. The A/D, I/B, and N/D groups were "pure" problems by definition and were, therefore, not reported in this Table.

### Comparisons of Sub-groups* with "Pure" Diagnoses

Comparison of the age walking among the "pure" sub-groups of the seven diagnostic categories is shown in Table 37. As can be seen, the F-ratio was significant, indicating that somewhere in the sub-groups there were significant differences in age of walking. All other "pure" sub-groups differed significantly from the M/R sub-group, which was according to expectancy. The I/B group differed significantly from the N/D group by a little more than two months, in favor of the children with immature behavior. This, perhaps, resulted from the fact that the N/D group contained some children with mental retardation who were known to be delayed, on the average, in all developmental areas; or children with language disorders, who, because of cerebral damage, may walk later because of motor problems. Briefly, age of walking tends to differentiate the mental retardation sub-group from all other sub-groups, but does not tend to differentiate the other sub-groups from one another, with the possible exceptions of children who were immature or whose problems were not differentiated.

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* The term "sub-group" refers to a division of the seven diagnostic categories, and can be either "pure" or "mixed" as explained on page 81. However, three of the diagnostic categories (Articulation Disorder, A/D; Immature Behavior, I/B; and Not Differentiated, N/D) did not have sub-groups, and were always considered "pure".

The age of first talking words among the seven "pure" sub-groups also showed marked differences as shown by the significant F-ratio in Table 38. The M/R sub-group talked words significantly later than all other sub-groups, with the exception of the H/L sub-group, where the N was very small, and the N/D group, which probably contained considerable mental retardation. As might be expected, the A/D group talked significantly earlier than the L/D, M/R and N/D sub-groups and more than four months earlier, on the average, than either the E/D sub-group or the I/B group, although these differences were not significant. In summary, the children with articulation disorders tended to talk words earlier than the other sub-groups and those with mental retardation tended to talk later than all other sub-groups. These findings do not deviate from expectancy.

The significant F-ratio in Table 39 indicates that there were significant deviations among the seven "pure" sub-groups in terms of age of talking sentences. The hearing loss sub-group was not considered in these data, owing to the small N of four. The A/D group again talked sentences earliest of all groups, but only to a significant degree when compared to the L/D sub-group and the M/R sub-group. The M/R sub-group talked, on the average, significantly later than all other groups with the exception of the N/D group, and the H/L sub-group which was not included here.

The F-ratio was also significant when the mean tested I.Q. scores for six of the "pure" sub-groups were compared (the M/R sub-group was excluded by definition), showing significant deviation among the groups. As seen in Table 40, the N/D group was the lowest of the six groups and differed significantly from all other groups. This was, again, probably due to a high incidence of mental retardation and organic problems in this group. In addition, the I/B group differed significantly from the A/D group as expected, since the immature group, although probably of normal intelligence, tested lower because of immaturity in behavior. This might be another example of pseudo-retardation. The L/D sub group also differed significantly from all other groups in their tested I. Q., with the exception of the I/B group. In fact, the L/D sub-group tested lower than all other groups which, again, obtains from the fact that pseudo-retardation was present. It was not surprising then, that there was less difference in the mean I. Q. scores of the L/D sub-group and the I/B group than between these two groups and the others.

Table 41, which compares the mean estimated potential I. Q. scores among the six "pure" sub-group categories, also suggests significant differences among the groups since the F-ratio was significant. The estimated potential mean I. Q. of the N/D group (as with the mean tested I. Q. score) was significantly lower than all other groups, supporting again the possibility of considerable mental retardation in this group. The L/D sub-group tested significantly lower than the H/L sub-group, which was probably due to communication and/or behavior problems during the testing situation in the L/D sub-group. It is interesting to note that the H/L sub-group was significantly higher in estimated potential I.Q. than all other groups. This may result from the fact that the intelligence test used to assess the intellectual potential of the H/L sub-group was different from those used with other groups and was of the type that might produce spuriously high scores. Even a "halo effect" might have accounted for a tendency of the examiner to over-rate the intellectual potential of children with hearing loss.

### Comparisons of Sub-groups with "Mixed" Diagnoses

Tables 42 through 46 are concerned with data from the "mixed" sub-groups only; for this reason, groups A/D, I/B, or N/D were not compared, since these groups were considered "pure" by definition.

A comparison of the mean age of walking for the "mixed" sub-groups of the four diagnostic categories can be seen in Table 42. The significant F-ratio indicates that the A/D sub-group walked significantly earlier than either the M/R or the L/D sub-groups, and approached a significant difference when compared with the H/L sub-group. Children with mental retardation would be expected to walk later than children with articulation disorders; and a similar expectancy might apply when children with language disorders (because of organic problems) and those with hearing loss (because of possible vestibular involvement) as compared with children with articulation disorders.

## Comparison of the "Total Mixed" Diagnoses

Comparison of the age of first words, for the "total mixed" sub-groups of seven diagnostic categories is shown in Table 43, and the significant F-ratio indicates significant differences among the seven groups. The A/D sub-group talked significantly earlier than the L/D, M/R, or H/L sub-groups. All of these differences were according to expectancy. The I/B sub-group talked, on the average, at a significantly earlier time than the H/L sub-group, which was also expected. The E/D sub-group was not included in this comparison because of the small N of four.

As was predicted, the F-ratio became significant when the age of talking sentences was compared among the sub-groups with "mixed" diagnoses. Table 44 shows that the I/B sub-group and the A/D sub-group talked sentences significantly earlier than the L/D, M/R, or H/L sub-groups. These findings are, of course, according to expectancy. The N/D group, despite the possibility of problems including mental retardation and cerebral damage, were found to talk sentences at a significantly earlier time than the H/L sub-group or the M/R sub-group. Again, no comparisons were made with the E/D sub-group because of the small N of two. Of interest is the fact that the L/D sub-group talked significantly earlier than the H/L sub-group. This suggests that both mental retardation and hearing loss contributes significantly to the retardation of sentence development. The X's on this table indicate that comparisons have been made previously among these three "pure" groups and are not repeated here.

Tables 45 and 46 are more interesting when viewed in relation to one another so that the differences between the tested and estimated potential I.Q.'s among the "total mixed" sub-groups can be examined. In tested I.Q.'s, the A/D group tested significantly higher than all of the "total mixed" sub-groups and the I/B group tested higher than all, with the exception of the H/L sub-group. The L/D sub-group was significantly higher than the E/D sub-group when tested, but when the estimated potential I.Q.'s were considered, the difference was not remarkable. The A/D group was not markedly different from the H/L group in potential I.Q.'s and the I/B group differed only from the E/D group. Of major interest here, is that the N/D group, although not different from the L/D sub-group when I.Q.'s were tested, showed significant differences (with the L/D sub-group being higher) when the I.Q.'s were estimated. Both the L/D and H/L sub-groups were within normal range on estimated potential I.Q. but they were distinctly below normal range when tested. This point will be discussed in more detail later in the text.

## Mixed Cases Excluding Mental Retardation

When the age of walking was compared for the "mixed" sub-groups of the seven diagnostic categories (excluding mental retardation from the "mixed" groups), there were only two sub-groups (L/D and H/L) having mixtures of primary problems with problems other than mental retardation. In Table 47 it can be seen that when these two sub-groups were compared, they did not differ significantly in the age of walking. However, as can be seen in Table 48, when these two sub-groups were compared in terms of talking words, the L/D sub-group talked significantly earlier than the H/L sub-group. As discussed previously, this would be according to expectancy. The A/D group was found to talk words significantly earlier than either of the mixed sub-groups without mental retardation (L/D and H/L). Although the I/B group did not differ significantly from the L/D sub-group in the age of talking words, the I/B group did talk words significantly earlier than the H/L sub-group. This difference also would be expected. There were no other significant deviations found among these groups.

In Table 49, the age of talking sentences was used to compare the two "mixed" sub-groups without mental retardation (L/D and H/L) with each other and with the three "pure" groups (A/D, I/B, and N/D). The F-ratio was significant for this table, and a significant difference was found between the A/D group and the L/D sub-group, indicating that children with articulation disorders talked sentences significantly earlier than children with mixed language disorders, excluding mental retardation. Other groups did not differ significantly when this aspect of speech development was considered.

When the mean tested I.Q. scores were compared among the two "mixed" sub-groups (excluding mental retardation), the comparisons showed that the H/L sub-group and the L/D sub-group did not differ significantly in tested I.Q. This was probably due to the fact that children with either language disorders or hearing losses can be difficult to evaluate on psychologic tests. However, the A/D group, who were not considered difficult to test, showed 13 points difference when compared with either the L/D sub-group or the H/L sub-group. The I/B group, although significantly different from the L/D sub-group, showed a difference of only seven points. The I/B group did not differ significantly from the H/L sub-group. This may have been due to the fact that the children with immature behavior were also difficult to evaluate and may have had psuedo-comprehension problems, similar to those found in children with language disorders. In addition, if a child with a hearing loss were difficult to test, there were more reliable psychologic tests available with which to evaluate these children than those with language disorders or immature behavior. The N/D group also showed a large difference of 13 points when compared with the H/L sub-group, and 11 points when compared with the L/D sub-group. Neither of these point advantages were in favor of the N/D group, since the children who were undifferentiated in this population were thought to have considerable mental retardation, a problem that was sifted out of the L/D and the H/L sub-groups before these comparisons were made. The H/L sub-group was not significantly different from either the A/D group or the I/B group, when the mean tested

I.Q.'s were compared. In fact, the H/L sub-group and the I/B group closely resembled each other. This information is contained in Table 50.

A comparison of the estimated potential I.Q. for the groups with "mixed" problems, excluding mental retardation, is reported in Table 51. In this Table, the F-ratio is also significant. It is important to note that when the potential I.Q. of those children who were thought to be difficult to examine on mental abilities tests (L/D, H/L, I/B), was estimated rather than tested, they appeared to be, on the average, as intellectually efficient as the children who tested more readily. In fact, the only significant differences occurred when the N/D group was compared with the L/D and H/L groups. Neither of these comparisons was in favor of the N/D group, apparently because a number of the children in this group were mentally retarded; a factor which had been excluded from both the other two groups. In summary, general differences between the L/D group and other groups were significant only when an attempt was made to test children with language disorders. However, these differences tended to equalize when the potential I.Q. was estimated, rather than tested, revealing, on the average, a potentially normal I.Q. for the language group. This was not true of the N/D group which was truly different from the L/D group because of mental retardation.

Table 52 shows the comparison of problems reported in the prenatal, birth presentation, neonatal, birth, postnatal histories and the organic problems, diseases, surgery, medical problems, psychoneurotic behavior, psychomotor behavior, and organic behavior for the "Pure" diagnoses in the seven diagnostic categories. Table 53 reports the same information for the "mixed" sub-groups.

This breakdown of the total diagnostic categories into "pure" versus "mixed" does not alter the relative incidence of the combined dichotomous variables for the two groups except in the following instances:

1. All of the postnatal problems of eczema, asthma and colic were found in the "pure" E/D group rather than the "mixed" E/D group, possibly because children with mixed problems (such as mental retardation and emotional disturbance) have frustration levels that are not reached as readily as children with primary emotional disturbance.
2. A relatively higher incidence of high temperature disease was found in the "mixed" L/D group when compared with the "pure" L/D group and is probably related to the higher incidence of multiple problems in the "mixed" group resulting from high febrile episodes.
3. There was relatively more psychoneurotic behavior in the "mixed" L/D group than in the "pure" L/D group and this is undoubtedly accounted for by the fact that children who are more severely involved (i.e., multiple problems) encounter more frustrations.
4. Although the N's were relatively small in both the "mixed" and

the "pure" M/R groups in terms of psychomotor behavior and organic behavior, there was relatively more incidence in the "mixed" group. This was not contrary to expectancy.

A comparison of the tested I.Q. and the estimated potential I.Q. within the diagnostic categories of the Total 503 Group is shown in Table 54. As can be seen in this Table, there were significant differences in some of the diagnostic categories of the total group between tested I.Q. and potential I.Q. For example, there was a difference of 13 points in the L/D group, indicating that either the examiners were too generous with their estimates of the potential of these children, (a problem which is implicit in any estimate of intellectual level) or, more likely, that the discrepancy results from the examiner's inability to test adequately children with language disorders. It may also be due to the fact that what is measured on an intelligence test does not give a true picture of a child's abilities if he has a language disorder. These explanations may also apply to the H/L and N/D groups, both of which had differences of 10 points between tested I.Q. and potential I.Q. Differences between these variables in the other groups were small and lacked statistical significance.

A comparison of the tested I.Q. and the estimated potential I.Q. within the sub-groups of the diagnostic categories for the Total 503 Group is reported in Table 55. This Table shows that the L/D group had differences that were approximately of the same magnitude in all of the L/D sub-groups and these differences were of statistical significance. Unlike the total E/D group, the "mixed" E/D group showed a difference of 22 I.Q. points between the tested and potential I.Q.'s which was significant. There was no such difference in the "pure" E/D group and this is related to the fact that multiple problems are more difficult to evaluate. In the H/L group, there were no significant differences in the sub-groups when compared to the total group. The M/R groups were not treated further since there were only 4 points difference in the total group.

Table 56 shows the comparison of age of first walking, age of first words, and birth weight among the sub-groups of the diagnostic categories of the Total 503 Group. The L/D sub-group comparisons consisted of the "pure" L/D versus L/D plus M/R and "pure" L/D versus total "mixed" L/D. The E/D sub-group comparisons consisted of "pure" E/D versus two-problem "mixed" E/D, "pure" E/D versus total "mixed" E/D, and "pure" E/D versus E/D plus M/R. The M/R sub-groups consisted of "pure" M/R versus two-problem "mixed" M/R, and "pure" M/R versus total "mixed" M/R. The H/L sub-group consisted of "pure" H/L versus total "mixed" H/L. All of the foregoing sub-groups were concerned with the comparison of "pure" sub-groups versus other sub-groups. In addition to these, there were also the "mixed" L/D sub-groups which consisted of L/D plus M/R versus "mixed" L/D without M/R and "pure" L/D versus "mixed" L/D without M/R, and one "mixed" H/L sub-group which consisted of "pure" H/L versus "mixed" H/L without M/R.

The N's were too small to make comparisons among many of these sub-groups, but those on which computations could be made showed the following results:

1. In most groups tested, the delaying factor in age of walking was mental retardation.
2. Sub-groups were too small to make significant comparisons on age of talking words.
3. Age of sentences, unlike age of walking, did not show significant deviations whether or not mental retardation was present.
4. Although an attempt was made to study the significance of difference in birth weight, there was not sufficient evidence of difference to suggest further exploration of this item. Other items such as sitting alone, feeding self, dressing self, and toilet training were not found to be valid items when this information relied upon parental memory alone. Therefore, these items, as well as birth weight, were eliminated from further consideration in this study.

There were two sub-groups that could not be included in Table 56, but showed possible differences between groups on estimated potential I.Q. so that a t-ratio was done on the data. One sub-group consisted of children who had been classified as mentally retarded with emotional disturbance, and the other sub-group of children who had been classified as emotionally disturbed with mental retardation. The purpose of this comparison was to determine if a child who was classified as being mentally retarded with an emotional problem was significantly different from a child who was classified as emotionally disturbed with mental retardation. The treatment of these two groups showed that the difference in estimated potential I.Q. was 20 points in favor of the E/D group with M/R, suggesting that in this as well as other categories there was a real difference between primary and secondary classifications. These were the only two groups of this type with sufficiently large N's to permit comparison.

In Table 57 are shown a sampling of correlations that were completed between Intelligence (both Tested I.Q. and Estimated Potential I.Q.) and Developmental Items (Age Walking, Age Talking Words, Age Talking Sentences). In general, these relationships were weak and no great importance can be attached to them. Even in a population of normal children it is generally known that these relationships are not strong, and in this population where the complexity of the problems themselves interfere with these relationships, the correlations might be expected to be even smaller. For this reason, only the relative magnitude of the correlations were considered and the absolute values were ignored.

The correlations were slightly higher between the Developmental Items and the Tested I.Q. than they were between the Developmental Items and the Estimated Potential I.Q. This was due to the fact that all of the children in the total sample population were known to be delayed in speech and language development and many of them were delayed in all developmental areas. Since the Tested I.Q. was consistently lower than the Estimated Potential I.Q. for all of the diagnostic categories, this stronger relationship with the Tested I.Q. would be expected.

The Age of Walking generally correlated higher with both the Tested and the Estimated I.Q. than did either of the verbal items (Age of Words or Sentences). This is explained by the fact that regardless of the type of problem in the seven diagnostic groups, all of these children were delayed in the acquisition of speech. This relationship between Age of Walking and Intelligence was stronger in the groups with Mental Retardation than in any of the other groups. However, in the groups with Mental Retardation, the correlation was even higher between Age of Sentences and Intelligence. This is related to the fact that with the exception of an isolated language deficit (as found in Language Disorders) we would expect to find that as intelligence scores became larger there should be more facility with the more complex aspects of communications, such as sentence structure.

## Conclusions and Recommendations

The total sample population in this portion of the study consisted of 503 children between the ages of three and nine years who were possibly mentally retarded and who had been referred for examination of their delayed speech and language development. The data were treated from three major standpoints: (1) Information concerning the Total $\overline{503}$ Group; (2) Comparisons of the seven diagnostic categories of the Total $\overline{503}$ Group; and (3) Comparisons of the sub-groups ("pure" and "mixed" problems) of the seven diagnostic categories of the Total $\overline{503}$ Group.

## The Total $\overline{503}$ Group

The Total $\overline{503}$ Group consisted of children with an average age of five years, born of relatively young parents, with birth weights not unlike the average birth weight in the general population. Race and socio-economic levels were distributed randomly thoughout the Total $\overline{503}$ Group, but the sex ratio was 2:1 in favor of the males, which corresponds with other reports of a higher incidence of males in all handicapped populations.

History and observation items were reported separately and also combined into broader groupings as follows: prenatal, neonatal, birth or postnatal problems and observations of psychoneurotic, psychomotor, or organic behavior. The Total $\overline{503}$ Group was found to have more than a 50 per cent incidence of prenatal problems, almost 16 per cent neonatal problems, and almost 92 per cent paranatal (birth) problems. Postnatal problems occurred in more than 11 per cent of this total sample population. Possible psychoneurotic behavior was reported in more than 51 per cent; possible psychomotor disturbance in almost 12 per cent; and possible organic behavior in almost 53 per cent.

When the Total $\overline{503}$ Group was sorted by primary classification into seven diagnostic categories, the total sample population consisted of 1/3 Language Disorders and about 1/5 each of Emotional Disturbance and Mental Retardation; other categories (Hearing Loss, Articulation Disorders, Immature Behavior, and Not Differentiated) ranged from five and one half per cent to nine per cent.

### The Seven Diagnostic Categories of the Total 503 Group

The seven diagnostic categories were compared in terms of history and test items, and the following conclusions resulted from those comparisons:

(1) Race, Sex, Socio-Economic Levels: There were no marked differences among the groups when the various socio-economic levels were compared, and Negroes were distributed randomly among the seven groups. The sex distribution differed markedly from group to group and to a significant degree. Males were especially prominent in the Language Disorder group (76 per cent) and in the Immature Behavior group (80 per cent). This is probably related to the fact that males are slower to develop, and according to other studies, more often incur cerebral damage or cerebral malfunction.

(2) Prenatal, Neonatal, Postnatal History: When the various individual history items were combined to form these informational units, the seven diagnostic categories could not be differentiated with respect to prenatal, presentation, labor, or delivery problems. Certain individual items, however, did tend to differentiate the groups as follows:

(a) Use of instruments in delivery was significantly higher in the Language Disorder, Emotional Disturbance, Immature Behavior, and Not Differentiated groups. The latter two groups had very small N's, but it is worthy of comment that the Emotional Disturbance group had as high an incidence of "instruments used" as the Language Disorder group. Although the use of instruments in delivery was not considered a causal factor in and of itself, the need for instruments in delivery suggests that a possible problem existed prior to the child's birth. This finding, therefore, supports contentions in other studies that congenital brain damage may be one causal factor for emotional disturbance.

(b) The reported incidence of "holding back head of child at time of delivery" was significantly higher in the Language Disorder, Mental Retardation, Emotional Disturbance, and Hearing Loss groups than it was in any of the other three groups. This suggests that if a child is "held back" when presentation processes have begun, there is a greater chance for resulting problems, probably as a result of anoxia.

(c) The incidence of reported anoxia was markedly heavier in the Language Disorder group (more than 25 per cent). The Mental Retardation, Emotional Disturbance, and

Immature Behavior groups ranged from four to 10 per cent in anoxia incidence; the Hearing Loss, Articulation Disorders, and the Not Differentiated groups had no incidence of anoxia.

(d) The incidence of convulsions was also significantly higher in the Language Disorder and Mental Retardation groups.

(3) Medical Diagnoses: All seven groups had a high incidence of medical problems, whether diagnosed or undifferentiated. Organic problems were extremely high in the Language Disorder group (4/5), markedly higher in the Mental Retardation group (2/5), and somewhat higher in the Emotional Disturbance, Not Differentiated and Hearing Loss groups than in the remaining two groups. Undifferentiated medical problems were present in over 1/2 of all groups, with the exceptions of the Mental Retardation and Language Disorder groups. A significantly higher incidence of anomalies was found in the Mental Retardation and Not Differentiated groups.

(4) Behavior problems reported by parents: A significantly higher incidence of nocturnal enuresis was found in the Mental Retardation, Emotional Disturbance and Not Differentiated groups. Sleeping problems, destructiveness, sibling rivalry, and temper tantrums occurred most often in the Emotional

Disturbance group. Temper tantrums were also present in about 1/5 of the Language Disorder and Hearing Loss groups, suggesting considerable (and possibly justified) frustration in these children. Body rocking, a psychomotor problem, occurred with significant frequency in the Mental Retardation, Emotional Disturbance, and Hearing Loss groups; hyperactivity, generally associated with organic problems, was present in over 1/4 of the Language Disorder and in 1/5 of the Not Differentiated groups. Short attention span and tremors both occurred most frequently in the Language Disorder and Mental Retardation groups; poor emotional tone was confined largely to the Emotional Disturbance group. Approximately 2/3 of the Language Disorder group could not localize the source of sound, while the incidence of this problem was less than 10 per cent in the other groups, with the exception of the Hearing Loss group (1/5). Nearly 50 per cent of the Language Disorder group had asteriognosis, 62 per cent had visual-motor problems, and nearly 80 per cent had comprehension problems.

(5) Objective Test Items: The Language Disorder, Mental Retardation and Not Differentiated groups were significantly less adequate in both geometric design and form board tests than were the other groups. The Hearing Loss group per-

formed more adequately on geometric designs than on form boards, as did the children with Immature Behavior. This difference is probably related to a developmental factor. However, it was interesting to note that the Articulation Disorder group performed significantly better on form boards than on geometric designs. Since geometric designs require eye-hand coordination, it is possible that the type of visual perception disorder often associated with reading disorders may also be present in children with Articulation Disorders, and that these children might be found to have reading disorders as well as speech disorders.

With reference to picture identification, almost 1/2 of the Language Disorder and Emotional Disturbance groups as well as more than 1/2 and about 2/3 of the Not Differentiated and Mental Retardation groups respectively were unable to identify pictures at all. The incidence in the Emotional Disturbance group was due to refusal to identify rather than to inability alone. Also, and as expected since these are verbal items, nearly 3/4 of the Hearing Loss group could not perform on this test.

When the speech development levels were studied, 1/2 of the Hearing Loss group and 1/4 of the Mental Retardation group had no speech. About 15 per cent of the Language Disorder, Emotional Disturbance, and Not Differentiated groups did not use speech. Incidence of no speech in the remaining two groups was negligible.

(6) Developmental Areas: The Language Disorder and Not Differentiated groups sat and walked alone as well as talked words and sentences significantly later than all other groups, with the exception of the Mental Retardation group (who were significantly slower in all development than all other groups) and the Hearing Loss group (who used sentences at a significantly later time than all other groups). There was more variability in talking words than sentences, suggesting that once words are achieved, sentences tend to develop regardless of the problem. (N.B. This conclusion is drawn without consideration for variation in the complexity of sentence structure.) The only exception to this conclusion was found in the Hearing Loss group, where the greatest lag between the acquisition of words and the development of sentences occurred. This can be explained by the fact that although a child with a hearing loss may acquire words at a comparatively normal age, his hearing deficit may retard or preclude the development of more complex communication at the sentence level.

Self help items such as bowel and bladder training, feeding, and dressing self occurred approximately at the same time in all groups with the exception of the Mental Retardation group, which showed a significant delay in all of these developmental areas. However, these items could not be used to differentiate the other groups.

(7) Intelligence: When the mean Tested I.Q. Scores were compared among the seven diagnostic categories, four of the groups were within normal range, the exceptions being the Language Disorder, Not Differentiated, and Mental Retardation groups. However, when the groups were compared in terms of Estimated Potential I.Q. Scores, the Language Disorder group had a mean 14 points higher on the average than the tested score and fell within normal range, while the Not Differentiated group had a higher potential intelligence score (by 10 points, on the average) than tested, and fell within the dull normal intelligence range. All other groups, including the Mental Retardation group, showed virtually no differences whether the I.Q. was tested or estimated.

**Comparisons of the Sub-groups of the Seven Diagnostic Categories**

The seven diagnostic categories of the Total $\overline{503}$ Group were divided into "pure" and "mixed" sub-groups on the basis of primary problem only ("pure sub-groups") and primary plus secondary problems ("mixed sub-groups"). The Articulation Disorder, Immature Behavior and Not Differentiated groups were considered "pure" by definition, since these categories did not include secondary classifications. Although these groups could not be divided into "pure" or "mixed" sub-groups, comparisons were made among these groups and the sub-groups of the other four diagnostic categories.

This comparison of the "pure" versus the "mixed" sub-groups did not alter the relative incidence of the combined groupings of the dichotomous variables for the total categories, except in the following instances:

(1) All of the postnatal problems of eczema, asthma, and colic were found in the "pure" Emotional Disturbance sub-group rather than in the "mixed" sub-group, perhaps owing to the fact that children with "mixed" problems, and therefore more severe problems, may have frustration levels that are not so readily reached as children with primary emotional disturbance.

(2) There was a relatively higher incidence of high temperature disease, psychoneurotic behavior, and psychomotor problems in the "mixed" sub-groups than in the "pure" sub-groups. This is undoubtedly accounted for by the fact that children who are more severely involved (i. e., multiple problems) tend to have complex disorders.

(3) Comparison of the Tested I. Q. and Estimated I. Q. scores

within the sub-groups showed that the Language Disorder sub-group, although significantly lower in tested I.Q. than all groups with the exception of the Not Differentiated and Mental Retardation sub-groups, was found to be within normal range when the I.Q. potential was estimated. This difference was probably due to the difficulty encountered in testing these children accurately.

(4) In most groups tested, the delaying factor in the age of walking was mental retardation. Although the sub-groups were too small to make significant comparisons on age of talking words, the age of talking sentences (unlike age of walking) did not show significant deviations whether or not mental retardation was present.

(5) There were no significant differences in birth weight, sitting alone, feeding self, dressing self, or toilet training. In fact, all of these items, with the exception of birthweight, were found to be invalid when the source of information relied on parental memory alone. All of these items, including birthweight, were eliminated from further consideration in this study.

(6) Only in two diagnostic categories were there sub-groups with identical but reversed primary and secondary classifications. One sub-group consisted of children who were classified as

Mentally Retarded with Emotional Disturbance; the other was classified as Emotionally Disturbed with Mental Retardation. A comparison of these two groups showed that the difference in Estimated Potential I.Q. was 20 points in favor of the Emotionally Disturbed with Mental Retardation sub-group, which indicated that in this sub-group, and presumably in all others, there was a real difference between primary and secondary classifications.

(7) Correlations between Intelligence and Developmental Items (walking, talking words and sentences) were generally weak. When the relative magnitude of these correlations were considered, it was found to be greater between the Developmental Items and the Tested I.Q. than with the Estimated Potential I.Q. In addition, it was greater with walking than with the speech variables except in the case of the groups with mental retardation, where it was found to be even greater in the age of talking sentences.

In summary, this portion of the study revealed useful information that could be used clinically for all of the diagnostic categories with the exception of the Not Differentiated group. Generally speaking, this group was found to be similar to the Mental Retardation and Language Disorder groups, and apparently consisted of children with both problems. Since the Not Differentiated group remained a clinical mystery, it was decided that a sample population should be selected similar to the Not Differentiated group so that this new series of children could be studied over a longer period of time and in a therapeutic setting. It was believed that through continued observations and repeated examinations the problems of these children could be differentiated.

# SECTION III

## Differentiation of Problems Through Diagnostic Therapy

## Introduction and Background

As indicated in the foregoing discussion, the only diagnostic category of the Total $\overline{503}$ Group that did not reveal a rather clear-cut clinical pattern was the Not Differentiated group. This was not contrary to expectancy, since a certain degree of ambiguity in this group was dictated by its definition. Nevertheless, when comparisons were made between this category and the other diagnostic categories, the Not Differentiated group was found to resemble more closely the Language Disorder and Mental Retardation groups than any of the other diagnostic categories. Since the same diagnostic procedures were used to evaluate all of the diagnostic categories, it was apparent that some other approach was needed to assure a more exacting diagnosis of this Not Differentiated group.

The approach selected involved the observation of this group for a period of six months in a therapeutic setting, with examinations before and after the term of therapy. It was believed that by combining long term observations with repeated examinations the problems of this group could be differentiated.

However, when attempts were made to schedule these children for re-examination it was found that this Not Differentiated group did not lend itself to further study for several reasons: (1) Many of these children were no longer within the age range selected for this project (three to nine years). Since the study of the Total 503 Group had required more than two years for completion. (2) Some of these children were no longer residents of Metropolitan Cleveland or the surrounding areas and distance precluded further evaluation. (3) A number of these children had been seen for reevaluation following their original study, and their problems had been clearly differentiated at that time. (4) Still others of these children (possibly because their problems had not been differentiated and they had, therefore, received no help with these disorders) had acquired additional problems which had complicated the clinical picture to an even greater degree. It was decided, therefore, that a new series of children would be studied and that attempts would be made to select those children who resembled, in as many ways as possible, the children who originally composed the Not Differentiated group.

From some 240 children who were referred for speech and language evaluation because of delayed speech and possible mental retardation, 50 children were selected on the basis of the following criteria: (1) All were between the ages of three and nine years. (2) A diagnosis of mental retardation had been made for all of these children but other possible problems were suspected. (3) The parents of these children were willing to participate in this six month study which entailed the examination of both the child and the parents. (4) There were no services available for any of these children since their problems could not be differentiated at the time of the initial evaluation. In other words, the selected group represented a type of child often seen in clinics throughout the country, where specific diagnoses of the problems are not possible and adequate sources of referral are not available. Briefly, the selected 50 children were between the ages of three and nine years, with delayed speech development and suspected mental retardation. Their parents were willing to cooperate in any way considered beneficial to the farther exploration of the child's problem, since no obvious sources of referral were available to them at the outset of this study. It is to be noted that children with more obvious problems of Emotional Disturbance, Hearing Loss, Articulation Disorders, Immature Behavior, Mental Retardation, or Language Disorders were excluded from this study.

## Procedures

The 50 children selected for diagnostic therapy or training (hereafter referred to as the T-50 Group) were examined in the same Physical Plant used in the study of the Total $\overline{503}$ Group (See Figure 1). The information obtained from evaluations of the T-50 Group were recorded on Record Form 2 which follows. As can be seen on this form, the same History Items recorded for the Total $\overline{503}$ Group were retained, but spaces to record the new Test Scores and Observations of Behavior were added. Appendix D discusses these additional items found on Record Form 2.

*Selection and Administration of Diagnostic Procedures:* Both the Pediatric and Audiologic examinations remained the same for the T-50

Group as for the Total $\overline{503}$ Group. However, the Psychologic and Language Evaluations of the T-50 Group added some procedures that were not included in the evaluations of the Total $\overline{503}$ Group. The objective tests used for these examinations included the following: The *Nebraska Test of Learning Aptitude* (66), *Columbia Mental Maturity Scale* (18), *Goodenough Intelligence: "Draw a Man"* (42), *Ammons Full Range Vocabulary Test* (4), *Vineland Social Maturity Scale* (23), *Ferguson Form Boards* (30), *Ontario School Ability Examination* (126)*. The same Geometric Design and Dominance (hand, foot, eye) Tests used to study the Total $\overline{503}$ Group were also included.

The Hiskey Test was selected for administration to all children, since this test did not require verbal responses from the subjects and because the test could be analyzed in terms of sub-test items, permitting a more detailed evaluation of abilities and disabilities on both an individual and group basis. The Ontario was used to evaluate those children who were too young or too involved to perform on the Hiskey. The Ontario, because it has items that are very similar to the Hiskey items, is often used in conjunction with the Hiskey to evaluate children at the lower levels of mental age. Since both of these tests were designed for use with the deaf child, they were found to be most useful in the examination of this selected population. Both tests were administered by using speech and/or

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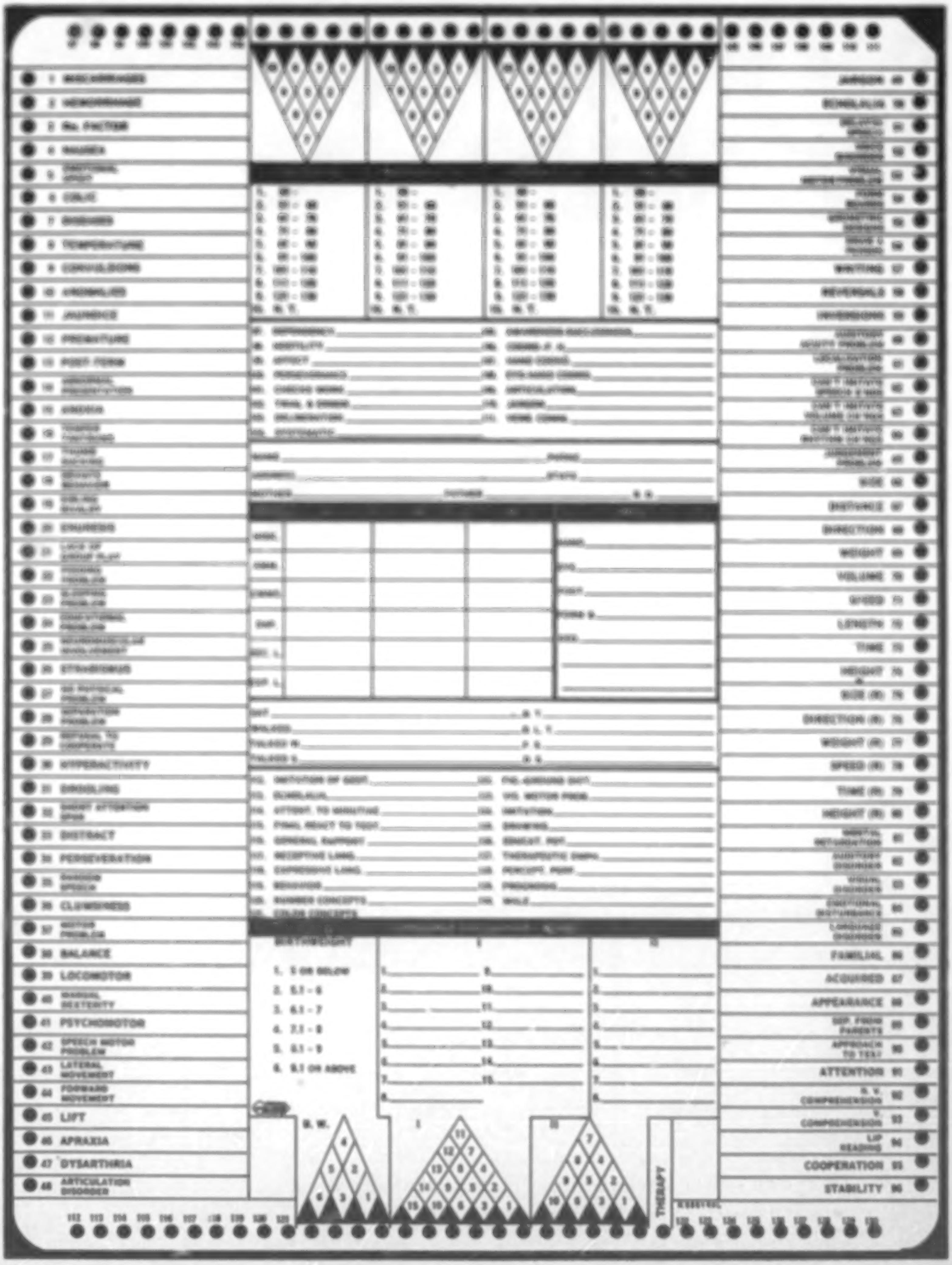
*Hereafter in the text, for purposes of brevity, these tests will be referred to as the Hiskey (66), Columbia (18), D.A.P. (42), Ammons (4), Vineland (23), Form Boards (30) and Ontario (126) respectively.

# RECORD FORM 2 - HISTORY AND TEST DATA



3 Rh. FACTOR
6 COLIC
30 HYPERACTIVITY
31 DROOLING
33 DISTRACT
34 PERSEVERATION
36 CLUMSINESS
38 BALANCE
39 LOCOMOTOR
40 MANUAL DEXTERITY
41 PSYCHOMOTOR
42 SPEECH MOTOR PROBLEM
43 LATERAL MOVEMENT
44 FORWARD MOVEMENT
45 LIFT
46 APRAXIA
47 DYSARTHRIA
48 ARTICULATION DISORDER

JARGON 49
ECHOLALIA 50
WRITING 57
REVERSALS 58
SIZE 66
DISTANCE 67
DIRECTION 68
WEIGHT 69
VOLUME 70
SPEED 71
LENGTH 72
TIME 73
HEIGHT 74
SIZE (R) 75
DIRECTION (R) 76
WEIGHT (R) 77
SPEED (R) 78
TIME (R) 79
HEIGHT (R) 80
MENTAL RETARDATION 81
AUDITORY DISORDER 82
VISUAL DISORDER 83
EMOTIONAL DISTURBANCE 84
LANGUAGE DISORDER 85
FAMILIAL 86
ACQUIRED 87
APPEARANCE 88
SEP. FROM PARENTS 89
APPROACH TO TEST 90
ATTENTION 91
N. V. COMPREHENSION 92
V. COMPREHENSION 93
LIP READING 94
COOPERATION 95
STABILITY 96

BIRTHWEIGHT

1. 5 OR BELOW
2. 5.1 - 6
3. 6.1 - 7
4. 7.1 - 8
5. 8.1 - 9
6. 9.1 OR ABOVE

pantomime when needed.

The Hiskey includes the following eleven sub-tests: Memory for Colored Objects (requiring Matching of Colors); Bead Stringing (requiring Speed, Copying Designs, Visual Retention of Patterns); Picture Association (requiring Association of Similarities); Block Building (requiring Copying Designs); Memory for Digits (requiring Visual Retention); Completion of Drawings (requiring Visual-Motor Performance and Closure); Pictorial Identification (requiring Matching); Paper Folding (requiring Visual-Motor Retention); Visual Attention Span (requiring Visual Retention); Puzzle Blocks (requiring Copying Designs); and Pictorial Analogies (requiring Sequential Organization).

In addition to the Hiskey and the Ontario, the psychologic consultant recorded specific observations of the child which were classified as follows: Appearance, Ability to Separate from Parents, Approach to Test Situation, Attention Span, Non-verbal Comprehension, Verbal Comprehension, Lip reading, Cooperation, Stability, Dependency, Hostility, Affect, Perseverance, Checks Work, Trial and Error, Deliberation, Systematic, Awareness-Successness, Coordination Finger-Hand, Hand Coordination, Eye-Hand Coordination, Articulation, Jargon, Verbal Communication, Imitation of Gesture, Echolalia, Attention to Minutiae, Final Reaction to Test and General Rapport. All of these aspects of behavior are defined in Appendix D.

The Language Evaluation of the T-50 Group included all of the

Test Items described in Appendix B, and in addition to these, the aspect of judgment was explored through a series of experimental items which are described in Appendix D. These items, although not standardized, were used to gain some degree of insight into the capacity of these children to judge certain relationships, which included differences in the following dimensions: Size, Distance, Direction, Weight, Volume, Speed, Length, Time and Height.

Observations During Therapy: Examination of each child was done prior to his being scheduled for therapy and again at the termination of the six month therapy period. It should be stressed here that this study was not designed to explore therapeutic techniques but rather to analyze the effects of long term observations of the differentiation of speech and language disorders. In other words, the major emphasis of this portion of the study was in relation to the diagnostic aspects of therapy and not to an evaluation of remedial measures per se.

Following the first evaluation series, the selected children were scheduled for individual therapy with one of three therapists. Every attempt was made to schedule these children with the therapist having the most experience in the type of therapeutic procedures considered necessary for remediation of the child's individual problem. One therapist had had considerable experience using the whole word approach in teaching children with Language Disorders (122); another was particularly skilled in the use of an individual sound approach (84, 104); and the third used a combination of these and other methods known to be effective in the teaching of children with speech and language disorders (182). Each child was scheduled for two half-hour individual therapy sessions per week.

Each Therapist kept detailed records on the behavior of each child during therapy and indicated whether or not problems were present in the following: Receptive Language, Expressive Language, Behavior, Number Concepts, Color Concepts, Figure-Ground Disturbance, Visual-Motor Problem, Imitation Ability, and Drawing Ability. Each therapist also estimated the child's Educational Potential, in terms of acceptance in regular classrooms; suggested the Therapeutic Emphasis thought to produce maximum results; and subjectively evaluated the child's Perceptual Performance by indicating whether or not a problem in perception was present. These aspects of behavior are discussed in Appendix D.

Parental Testing: The Parents of each child were also examined in order to determine their general intellectual level. The attitudes of the parents both toward their child and their environment were also explored. All of the parents were requested to attend group parent meetings scheduled at least once a month, at which times the various members of the project staff discussed their methods of evaluation and the purposes of the testing sequence. Individual parent conferences were held approximately once a week. The tests used to evaluate the parents were the *Henmon-Nelson Test of Mental Ability; Grades 9-12* (51), and the *Edwards Personal Preference Schedule* (25). These tests were selected because of ease of administration and scoring. A detailed discussion of the results of these tests and the information obtained from parent conferences will not be discussed in this report since they are being analyzed currently in a doctoral dissertation at Western Reserve University.

## Results

Tables 58 through 68 are included for inspection since they describe the T-50 Group in terms of the same continuous and dichotomous variables that were used to study the Total $\overline{503}$ Group. Since the T-50 Group had been selected on the basis of their resemblance to the Not Differentiated diagnostic category of the Total $\overline{503}$ Group, these two groups also were compared on these same continuous and dichotomous variables. As can be seen in Table 69, the Total T-50 Group did not differ markedly from the Not Differentiated Group on any of these variables.

The T-50 Group was studied over a period of six months and each child in the group was re-examined periodically. These observations and test results provided adequate information for the division of the T-50 Group into the following sub-groups: a "pure" sub-group, consisting of children with fairly "pure" Language Disorders (L/D = 22 or 44 per cent); a "mixed" sub-group, consisting of children with Language Disorders plus Mental Retardation (L/D + M/R = 23, or 46 per cent; and a smaller sub-group, consisting of children with Mental Retardation only (M/R = 5, or 10 per cent). This division of the T-50 Group into sub-groups is reported in Table 70 and, for purposes of inspection, Table 71 shows the incidence of the continuous variables for the five children classified as Mentally Retarded.

In order to see how the "pure" L/D sub-group of the T-50 Group compared with the "pure" L/D sub-group of the Total $\overline{503}$ Group, Table 72 was prepared. As this Table shows, the two sub-groups were similar in Developmental Areas, Intelligence, and Prenatal, Neonatal and Postnatal History. They were also alike in Medical History and Behavior, with the exception of Psychoneurotic Problems where the "pure" sub-group of the T-50 Group had a little more than twice the relative incidence (64 per cent) than the "pure" sub-group of the Total $\overline{503}$ Group. This suggested that the "pure" sub-group of the T-50 Group might be more difficult to manage in a therapeutic setting.

Comparisons of the "mixed" L/D + M/R sub-group of the T-50 Group with the "mixed" L/D + M/R sub-group of the Total 503 Group showed that these two sub-groups were also quite similar in Developmental Areas and Intelligence. Table 73 indicates that there were proportionately more Neonatal Problems in the sub-group of the Total $\underline{503}$ Group, than in the T-50 sub-group. However, the most striking difference between these two sub-groups was found in the Psychomotor Problems which existed in 39 per cent of the T-50 sub-group but in none of the sub-group of the Total $\overline{503}$ Group. This suggested that although the histories of the two sub-groups were similar, there was evidence of more organicity in the T-50 "mixed" sub-group.

Turning now to the T-50 Group, the "pure" L/D sub-group was compared with the "mixed" L/D + M/R sub-group on the continuous and combined dichotomous variables. In this comparison it was found that the "pure" sub-group was significantly earlier in walking alone; had significantly higher scores on the Hiskey and Columbia Tests; performed more adequately on Form Boards and Geometric Designs; and obtained remarkably higher Social Quotients on the Vineland. These comparisons can be seen on Table 74.

There were no differences between these two sub-groups of the T-50 Group in terms of Race, Sex, or Socio-economic levels. Comparison between the two sub-groups was not made on the incidence of Articulation Disorders since the N's were too small; and other speech classifications (No Speech, Delayed Speech, Jargon, and Echolalia) were compared but showed no significant differences. The N's were also too small to compare the Prenatal, Birth, Neonatal or Postnatal History items of the two sub-groups; however, as can been seen in Table 75, a major difference between the two sub-groups was found in the incidence of Psychomotor Problems. In this area, the "mixed" sub-group was found to have a reported 39 per cent while the "pure" had only nine per cent.

Behavior Problems as reported by parents had small N's or they were not significant. When comparing the two sub-groups in terms of

Behavior Problems as reported by examiners, many of the N's were also too small. However, as can be seen in Table 76, significant differences or tendencies toward marked differences were found in three behavioral aspects. Short Attention Span approached but did not quite reach significance, with 27 per cent of the "pure" sub-group having Short Attention Span while 57 per cent of the "mixed" sub-group had this problem. This finding tends to relate Short Attention Span more to Mental Retardation than to central nervous system involvement. Lateral Movement of the tongue was impaired in only 18 per cent of the "pure" sub-group but in almost three times as many (52 per cent) of the "mixed" sub-group. This suggested that there was greater damage in the "mixed" sub-group, leading to more motor involvement. Visual-Motor problems were present in 45 per cent of the "pure" sub-group but in almost twice as many (87 per cent) of the "mixed" sub-group, reinforcing the statement made above that greater organicity was found in the more severe "mixed" problems.

Comparisons were made also between the two sub-groups in terms of Objective Test Items. As Table 77 shows, differences were significant when the two sub-groups were compared in terms of performance on Geometric Designs and Form Boards and the difference approached significance on the D. A. P. Test.

In Judgment of Relationships, as shown on Table 78, differences between the groups were not significant when Distance, Length, Time or Height were considered, and only approached significance in the areas of

Direction, Weight and Volume. In Size and Speed, however, differences were marked, and to a significant degree. These differences might be explained by the fact that judgments involving such characteristics as differences in Distance, Length, Time and Height are extremely abstract. Since children with Language Disorders have pronounced difficulties in dealing with abstractions, the "pure" and the "mixed" sub-groups would be similarly penalized in these performances and no significant differences between the groups would be expected. However, in the case of Direction, Weight, and Volume, where abstraction is lessened, (particularly in judgment of Weight and Volume where objects were used to aid judgment), the children with Language Disorders tended to do better in judging these differences. Judgments of Size and Speed were even less abstract as measured in this study, and these test items clearly differentiated the "pure" sub-group from the "mixed" sub-group. All of these findings resulted from Tests administered by the examiner in the room with the child.

It was also interesting to note that when the children in both sub-groups were asked to judge relationships in terms of Size, Direction, Weight, Speed, Time and Height (administered by the examiner in the control room, in order to eliminate all extraneous cues) almost 55 per cent of the "pure" sub-group and 39 per cent of the "mixed" sub-group became echolalic, repeating the questions or portions of them. This response occurred even in children who may not have used echolalia during the test procedures prior to this time.

Table 79, which reports the comparison of the two sub-groups in terms of Observations During Testing, shows that the "mixed" sub-group had more than three times as many problems in Affect and Imitation of Gestures as did the "pure" sub-group. This is probably because children with Mental Retardation are less aware of what is going on in the environment than are children who do not have Mental Retardation. There were also twice as many Trial and Error problems, absence of Deliberation, lack of Awareness of Success, and Finger-Hand Coordination problems in the "mixed" sub-group than in the "pure" sub-group. Apparently all of these factors are more closely associated with Mental Retardation than with Language Disorders.

Receptive Language Disorders were much greater in the "mixed" sub-group, suggesting that many Receptive Language Disorders are due to Mental Retardation and not to Language Disorders per se. Behavior Problems were much more common in the "mixed" sub-group, as were Figure-Ground Disturbances (five times greater), Visual-Motor Problems (four times greater), and Imitation Problems (twice as great). These findings point out that although a child with a Language Disorder may have a Figure-Ground Disturbance and/or a Visual-Motor Problem, these disorders are related to central nervous system damage and are not characteristic of Language Disorders per se (See Table 80).

Comparison of various test scores before and after therapy showed that all of the test scores were significantly higher at the termination of therapy than in the beginning. As can be seen in Table 81, the T-50 Group showed a mean difference of 13 points on the Hiskey, about 10 points on the Ammons, almost 14 points on the Columbia, and a little more than seven points on the D. A. P. In general, these differences reflect the latent potential in children with Language Disorders; potential which can only be demonstrated after a period of careful diagnostic therapy.

This significantly higher performance following therapy was also found in all of the sub-groups. The "pure" L/D sub-group obtained remarkably higher scores on all of these tests following therapy and the "mixed" L/D + M/R sub-group differed to a lesser but still to a significant degree on these test scores. It is interesting to note that the "pure" L/D sub-group showed relatively higher gains than did the "mixed" L/D + M/R sub-group on the Ammons (approximately 13 and seven points respectively) while the "mixed" L/D + M/R sub-group had a proportionately higher mean score than the "pure" L/D on the D. A. P. (more than 15 and three points respectively). Since the Ammons evaluate Language Abilities and the D. A. P. measures Visual-Motor performance, these improvements are probably reflections of therapy emphases. This information is contained in Tables 82 and 83. As can be seen on Table 84, the children with primary Mental Retardation did not show remarkable changes, but even in these children who were mentally retarded, some improvement was noted.

In Table 85, quotients for each of the eleven sub-tests of the Hiskey were computed by dividing the child's chronological age into the mental age which he had earned on each sub-test. The Total T-50 Group was found to have mean scores ranging from 112 on Completion of Drawings and Pictorial Identification to 76 on Paper Folding. Since the F-ratio was significant for this total group, it was necessary to explore the two sub-groups in order to pinpoint this variation.

The F-test on the "mixed" L/D + M/R sub-group was not significant; apparently when Mental Retardation and Language Disorders occur concomitantly, the Mental Retardation tends to flatten the profile and no sub-test score differs from any other sub-test score except by chance.

On the other hand, the F-ratio was significant in the "pure" L/D sub-group, indicating that variations in the scores of the eleven sub-tests were not chance occurrences. Using a test for significant gaps, it was found that performance on Paper Folding resulted in significantly lower scores than those obtained on the Pictorial Association, Pictorial Identification, Visual Attention Span, or Pictorial Analysis sub-tests. The "pure" L/D sub-group also performed less adequately on Bead Stringing than on Picture Identification.

Of primary importance is the finding in the "pure" L/D sub-group of markedly better performance on Completion of Drawings than on all other sub-tests. In fact, performance on this sub-test resulted in a mean score of 137, much higher than would be expected in the normal population, and 60 points higher than that earned by the "mixed" L/D ≠ M/R sub-group.

The Completion of Drawings sub-test involves two elements: Visual-Motor Performance and Closure. A child with a Language Disorder, presumably from brain damage, is classically discussed as one who would perform poorly on a test item combining these two aspects of performance. That this child may have Visual-Motor problems, and disturbances in Visual Perception, including Closure, has been pointed out repeatedly by others. It was, therefore, unexpected that the "pure" L/D sub-group would score higher on the Completion of Drawings sub-test than any other sub-test and even more remarkable that they would score higher on this sub-test than would be expected in the normal population. Nevertheless, the findings in this study seemed to indicate that when a Language Disorder is complicated by Mental Retardation (as in the "mixed" L/D ≠ M/R sub-group), it is the Mental Retardation that reduces the effectiveness of these children in functions requiring Visual-Motor Performance and Closure.

To go even further, the extraordinarily high mean score achieved by the "pure" L/D sub-group on this sub-test suggests that in the absence of Mental Retardation, there is a superior performance, perhaps even a "forced responsiveness" to Closure. This behavior is not unlike the extreme meticulosity and need for routine that is often reported in the history of these children. Therefore, it seems to follow logically that these children with relatively "pure" Language Disorders have a perceptual problem that is basic to a constant need for Closure rather than an inability to achieve it.

This preoccupation with Closure may account for some of the behavior usually associated with these children such as: Visual-Motor Problems, Figure-Background Disturbances, Hyperactivity, Inattention to Sound, Retention Disorders, etc. In fact, many of the behavior problems of children with Language Disorders may result from this inability to be flexible in any situation.

This concept has many implications for the education of these children, one of the most important being the necessity for gradually reducing the structure in a therapeutic setting so that these children can learn to adjust to an environment that is constantly changing. It should be understood that this child has an unrelenting need to anchor himself in a world that is turning too fast for him. He attempts to do this through forcing himself to achieve Closure in every situation; and he overdoes it. Apparently, it is not enough to teach these children in an atmosphere having so much structure that what the child learns in a therapeutic or educational setting cannot be used in a less structured environment. This emphasizes the already obvious need for additional studies of therapeutic and education procedures for children with Language Disorders.

## Conclusions and Recommendations

The purpose of this section of the project was to study 50 children selected because of their resemblance to the Not Differentiated Diagnostic Category of the Total $\overline{503}$ Group. Since the diagnostic methods used with the total sample population had not been successful in delineating this diagnostic category, it was believed that a different approach, combining long term observations in a therapeutic setting with repeated evaluations of each child, might be effective in differentiating their problems. This aspect of the study resulted in the following conclusions and recommendations:

(1) When a specific diagnosis of a child's problem cannot be made on the basis of test results alone, his problem is more accurately analyzed through diagnostic therapy which combines long term observations with repeated examinations.

(2) When comparisons were made between the selected 50 children (T-50 Group) and the Not Differentiated Diagnostic Category of the Total $\overline{503}$ Group, the two groups were not found to differ markedly on any of the variables compared, and these two groups were considered to be random samples from the general population.

(3) The T-50 Group was studied over a period of six months and each child was re-examined periodically. This information lead to the division of this group into three sub-groups: a

"pure sub-group consisting of children with relatively pure Language Disorders (22, or 44 per cent); a "mixed" sub-group, consisting of children with Language Disorders plus Mental Retardation (23, or 46 per cent); and a much smaller sub-group consisting of children with Mental Retardation only (5, or 10 per cent).

(4) Comparisons between "pure" and the "mixed" sub-groups indicated that their backgrounds and histories did not differ except in the incidence of Psychomotor Problems, Short Attention Span, Impaired Lateral Movement of the Tongue, and Visual-Motor Problems. On all of these variables, the "mixed" sub-group had a significantly higher incidence of problems. This suggests that although the histories of the two sub-groups were similar there was *evidence of more organicity* in the "mixed" sub-group.

It was also found that the "pure" sub-group had significantly higher scores than the "mixed" sub-group on the Hiskey, Columbia, Vineland, and performed more adequately on Form Boards and Geometric Designs. In Judgment of Relationships, the "pure" sub-group was significantly more accurate in judging differences in Size and Speed than was the "mixed" sub-group. Since children with Language Disorders are known to have difficulty with abstractions, these differences were probably due to the more concrete nature of these two dimensions than the others considered in this study (viz., Distance, Length, Time, Height, Direction, Weight, and Volume).

The "mixed" sub-group was found to have significantly more problems in Affect, Imitation of Gesture, Trial and Error Problems, Deliberation, Awareness of Success, Finger-Hand Cordination, Receptive Language Disorders, Figure-Ground Disturbances, Visual-Motor Problems, and Imitation Problems. This suggests that these behavior problems are more closely associated with Mental Retardation than with the Language Disorders per se.

(5) When the scores of the "pure" and "mixed" sub-groups on the Hiskey sub-tests were compared there was no significant variation found in the "mixed" sub-group which suggests that the presence of Mental Retardation tends to flatten the sub-test profile. However, the "pure" sub-group showed significant variation on sub-test scores. Of primary importance was the finding that this sub-group scored higher on the Completion of Drawings sub-test (which requires Visual-Motor Performance and Closure) than any other sub-test and higher even than would be expected by normal children. This suggests that children with relatively "pure" Language Disorders have a constant need for Closure rather than an inability to achieve it. One of the most important implications that can be drawn from this finding is the necessity for gradually reducing the structure in a therapeutic setting so that these children can learn to adjust to an environment that is constantly changing.

## Abstract

Of primary importance to the habilitative planning for children with communication disorders is an accurate diagnosis of the problems. Unfortunately, causes of delayed speech and language development vary and are difficult to differentiate, resulting at times in diagnostic error. For example, a mild degree of mental retardation is frequently present, which is often confused with more nebulous causes of language delay. Other causes, like emotional disturbance, simulate mental retardation. In addition, multiple etiologies, when undifferentiated, can look like mental retardation. It is tempting, in the absence of a clear-cut diagnosis, to use the classification of mental retardation as an explanation for all delayed speech. This is an extremely dangerous procedure.

Concern with the careless designation of mental retardation as a cause of delayed speech lead to an initial study of 1200 previously recorded and randomly selected case records of children with delayed speech. In many of these case histories, the diagnosis of mental retardation was unequivocal; however causes were obscure for nearly 30 per cent, creating the danger of a false diagnosis of mental retardation. Re-examination of 239 of these children showed that only 21 per cent were truly mentally retarded. Additionally, even with this more searching evaluation, four per cent of the etiologies remained doubtful.

At this point the question naturally arose, "Could improved use of history and test items illuminate these difficult diagnostic problems, avoiding a false diagnosis of mental retardation?" In an attempt to answer this question, a factor analysis of more than 100 history and test items was completed; but this treatment failed to uncover any new approach to the problem. Accordingly, this retrospective approach to the problem was abandoned.

This was followed by a study of a new series of 503 children (ages three to nine) which provided a fresh approach to the problem. Again there was delayed speech and language development; again a suspicion of mental retardation. However, there was also clinical evidence that these children could perform at a higher level than superficial examination had disclosed. The use of the same tests and history items, administered always by the same highly experienced diagnostic team, added uniformity to the study. Through intensive analysis, each child was classified in one of six diagnostic categories, some with "pure" and some with "mixed" etiologies. The diagnostic categories included: Language Disorders (1/3); Emotional Disturbance (1/5); Mental Retardation (1/5); and lesser proportions of Hearing Loss, Articulation Disorders, and Immature Behavior. Nevertheless, despite thorough diagnostic procedures, there remained a

seventh group of 28 children who could not be diagnosed, i. e., a Not Differentiated group.

A highly specialized staff, large batteries of tests, lengthy histories, and considerable time were needed to resolve the problems of these children. To find definitive history or test items, items which could delineate these problems with greater certainty and with less effort, was therefore our next task. Intensive analysis brought to light several items which were more closely related to one category than to another, furnishing valuable clues for a more exacting diagnosis of these problems. A few history and test items were found to be much more common to certain categories than to others, for example: Instrument Deliveries and Holding Head Back were uncommon in the Hearing Loss, Articulation Disorder and Mental Retardation groups. Temper Tantrums were more prevalent in the Mental Retardation, Emotional Disturbance, and Hearing Loss Groups. Body Rocking characterized the Mental Retardation, Emotional Disturbance, and Hearing Loss groups.

Several items tended to link the Mental Retardation, Language Disorder, and Not Differentiated groups, such as: all were slow in Developmental items; all were poor on Form Boards and on Geometric Designs; all were below normal when intelligence was tested;however, when intellectual potential was estimated, children with Language Disorders were found to be within normal range. The Not Differentiated group also improved 10 points approaching normal range; but the Mental Retardation group did not change from one test situation to another.

Other history and test items were prevalent in only two categories, tending to eliminate the remaining five, namely: the Articulation Disorder and Immature Behavior groups were far superior to all others on Picture Identification; Poor Sound Localization was common to the Language Disorder and Hearing Loss groups; a preponderance of males was found in the Language Disorder and Immature Behavior groups; if the child were Hyperactive, he was more likely found in the Language Disorder or Not Differentiated groups. Anomalies were common only in the Mental Retardation and Not Differentiated groups. Several items were more prevalent in both the Language Disorder and Mental Retardation groups, viz: Convulsions, Tremors, Short Attention Span, and Organic Problems.

Finally, some history and test items characterized only a single category, such as: only in the Articulation Disorder group was performance on Form Boards significantly better than on Geometric Designs; the Hearing Loss group was unique in the late Onset of Sentences and the great lag between Onset of Words and Onset of Sentences; if there were a great many Sleeping Problems, or considerable Sibling Rivalry or Destructiveness, or if the Emotional Tone were poor, the child was most likely to be Emotionally Disturbed. Only the Mental Retardation group was significantly late in developing Self Help items. The Language Disorder group led all other groups on the incidence of several items: Anoxia, Asteriognosis, Visual-Motor Problems, and Comprehension Problems.

Not only did the seven diagnostic categories differ significantly from one another, but a few of the "pure" and "mixed" sub-groups differed on some items. All Colic, Eczema, and Asthma problems, for example, were found only in the "pure" Mental Retardation sub-group, possibly owing to higher frustration levels in "mixed" problems. Greater damage was probably related to the greater incidence of High Temperature Diseases, Psychoneurotic Behavior, and Psychomotor Problems in most "mixed" sub-groups. Finally, all "mixed" sub-groups with mental retardation walked later than those without.

It was the Not Differentiated group, however, which presented the greatest need for diagnostic insight. The analysis of test and history items suggested that a mixture of Language Disorders and Mental Retardation best characterized this group. There was a high incidence of Instrument Deliveries, Holding Head Back, Hyperactivity, and a better Estimated Potential than Tested I. Q. hinted of a Language Disorder; conversly, Anomalies suggested Mental Retardation. Additionally, the Not Differentiated group was similar to both the Language Disorder and Mental Retardation groups in the high incidence of Eneuresis; poor performance on Form Boards, Geometric Designs, Picture Identification; slow Development and a Tested I. Q. which was below average.

Although there were similarities between both the Language Disorder group and Mental Retardation group when compared separately with the Not Differentiated group, the latter went undiagnosed despite all diagnostic attempts, and diagnostic therapy remained the only solution for the differentiation of these problems.

Therefore, a new series of 50 undifferentiated children, like the Not Differentiated group in all important respects, was studied in diagnostic therapy for six months. Many diagnostic procedures were used both before and after therapy, and these, along with the judgments of therapists, permitted classification of these children into the following groups: "pure" Language Disorder (44 per cent); "mixed" Language Disorder with Mental Retardation (46 per cent); and "pure" Mental Retardation (10 per cent).

Of immediate concern following the classification of these 50 children, was the need for delineating clearly the two large sub-groups, Careful study of test and history items disclosed marked differences between the two groups. More organicity and greater damage characterized the "mixed" sub-group, indicated by a higher incidence of the following: Psychomotor Problems, Short Attention Span, Visual-Motor Problems, and Impaired Lateral Movement of the Tongue. The "pure" sub-group, on the other hand, performed significantly better on the following test items: The Hiskey and Columbia intelligence tests, Vineland Social Maturity Scale, Form Boards and Geometric Designs, and Size and Speed judgments. Other judgments (Distance, Length, Volume, Time, Height, Direction and Weight), owing to their more abstract nature, failed to differentiate the two groups.

Of particular interest was the superiority of the "pure" sub-group on items generally associated with the "brain-damage" syndrome. Apparently these problems are more accurately associated with mental retardation than language disorders per se, such as problems in Affect, Imitation of Gesture, Trial and Error, Deliberation, Lack of Awareness of Success, Finger-Hand Coordination, Figure-Ground Disturbance, Visual-Motor Function, and Imitation.

Finally, equal ability in all facets of intelligence characterized the "mixed" sub-groups. However, a jagged profile, with a surprising superiority on tasks requiring Visual-Motor Coordination and Closure, marked the "pure" language group. General thinking to the contrary, children with pure language Disorders may have strong need for Closure rather than incapacity for it. Implied here are therapy requirements aimed at reducing the need for structure, and gradually adapting the child to change.

Here, then, is the focal point of this study; that is, that children with Language Disorders must be educated in an environment that gradually reduces the child's need for structure rather than perpetuating this need by providing structure to such a degree that the child's adaptation to everyday change is impossible. Indeed, this accents the urgent need for new studies of the whole general approach to these children in a therapeutic setting, if erroneous diagnoses of mental retardation are to be avoided.

# Appendix A

## Items Used in the Correlation Matrix
## (Source of Information for Each Item Indicated in Parentheses)

(1) Sex of the child (parental report):
    (0) Male
    (1) Female

(2) Meningitis (medical reports):
    (0) No
    (1) Yes
    (2) Possible

(3) Encephalitis (medical report):
    (0) No
    (1) Yes
    (2) Possible

(4) Other speech problems in family (parental report):
    (0) None
    (1) On father's side of family
    (2) On mother's side of family
    (3) Both (1) and (2)

(5) Behavior change following illness (parental report):
    (0) No
    (1) Yes

(6) Perseveration (psychologic report):
    (0) No
    (1) Yes

(7) Visual - Motor problem (psychologic report):
    (0) No
    (1) Yes

(8) Indication of developmental lag in all areas but with normal potential (medical reports):
    (0) No
    (1) Yes

(9) Indication of child's inability to comprehend speech (psychologic report):
- (0) No
- (1) Yes

(10) Indication of general immaturity in all areas but with normal potential (psychologic report):
- (0) No
- (1) Yes

(11) Attention span short during testing (psychologic report):
- (0) No
- (1) Yes

(12) Estimation of potential I.Q. (psychologic report):
- (0) Same as tested
- (1) Higher than tested

(13) Indication of a central nervous system involvement (medical reports):
- (0) No
- (1) Yes

(14) Anomalies such as cleft palate, clubbed feet, etc. (medical reports):
- (0) No
- (1) Yes

(15) Results of Electroencephalographic studies, if given (medical reports):
- (0) Negative
- (1) Positive
- (2) Undetermined
- (3) Recommended but no report available
- (4) Not given

(16) Results of Pneumoencephalographic studies, if given (medical reports):
- (0) Negative
- (1) Positive
- (2) Undetermined
- (3) Recommended but no report available
- (4) Not given

(17) Indication that drugs were recommended and/or used (medical reports):

- (0) None
- (1) Previously used
- (2) Currently used
- (3) Recommended but not used
- (4) No report

(18) Environmental change (parental report):

- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(19) Speech therapy scheduled (speech and language reports):

- (0) No
- (1) Yes

(20) Surgery completed (medical reports):

- (0) No
- (1) Routine surgery(such as tonsillectomy)
- (2) Specific surgery (such as surgery on the brain, heart, etc.)
- (3) Both (1) and (2)

(21) Indication of emotional disturbance (psychologic report):

- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(22) Age at examination (parental report):

- (0) 3.0-3.9 years
- (1) 4.0-4.9 years
- (2) 5.0-5.9 years
- (3) 6.0-6.9 years
- (4) 7.0-7.9 years
- (5) 8.0-8.9 years

(23) Incidence of miscarriages (parental report):

- (0) None
- (1) One reported
- (2) More than one reported

(24) Rh Factor (parental or medical reports):
- (0) None
- (1) Reported
- (2) Reported-but no transfusion
- (3) Reported-with transfusion
- (4) Other blood incompatibility reported

(25) Chronic maternal nausea throughout pregnancy (parental report):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(26) Hemorrhage during pregnancy of child being studied (parental report):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(27) Toxemia during pregnancy of child being studied (parental report):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(28) Extreme emotional tension of mother during pregnancy of child being studied (parental report):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(29) Health of mother during pregnancy of child being studied (parental report):
- (0) Excellent
- (1) Good
- (2) Poor
- (3) Fair

(30) Indication of anoxia (medical or parental reports):
- (0) None
- (1) Mild

(30) Indication of anoxia (Continued)
- (2) Moderate
- (3) Severe

(31) Kernicterus (medical or parental reports):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(32) Child placed in incubator (medical or parental reports):
- (0) Not used
- (1) Less than 1 week
- (2) 1-2 weeks
- (3) 3-4 weeks
- (4) 4-5 weeks
- (5) 5 weeks or more

(33) Colic (parental reports):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(34) Eczema (parental reports):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(35) Asthma (parental reports):
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(36) Febrile Episodes (parental reports):
- (0) None
- (1) With childhood disease
- (2) With convulsion
- (3) Unexplained

(37) Convulsions (parental reports):
- (0) None
- (1) Only one episode
- (2) Several episodes

(38) Birth Weight (parental report):
- (0) 2-2.9
- (1) 3-3.9
- (2) 4-4.9
- (3) 5-5.9
- (4) 6-6.9
- (5) 7-7.9
- (6) 8-8.9
- (7) 9-9.9
- (8) 10-10.9
- (9) 11-11.9

(39) Difference in parents' ages; Father older (parental reports):
- (0) Father 10 years older or more
- (1) Father 6-10 years older
- (2) Father 1-5 years older
- (3) Same age

(40) Difference in parents' ages; Mother older (parental reports):
- (4) Mother 1-5 years older
- (5) Mother 6-10 years older
- (6) Mother more than 10 years older

(41) Age child first sat alone (parental report):
- (0) Under 6 months
- (1) 6 months
- (2) 7 months
- (3) 8 months
- (4) 9 months
- (5) 10-12 months
- (6) Over 12 months

(42) Age child first walked alone (parental report):
- (0) Under 12 months
- (1) 12 months
- (2) 13 months
- (3) 14 months
- (4) 15-18 months
- (5) 19-24 months
- (6) Over 24 months

(43) Age child first talked words (parental report):
- (0) Under 12 months
- (1) 12-18 months
- (2) 19-24 months

(43) Age child first talked words (Continued)
- (3) 25-30 months
- (4) 31-36 months
- (5) Over 36 months

(44) Age child first talked sentences (parental report):
- (0) Under 24 months
- (1) 25-30 months
- (2) 31-36 months
- (3) 37-42 months
- (4) 43-48 months
- (5) 49-54 months
- (6) Over 54 months

(45) Age child was first bowel trained (parental report):
- (0) Under 12 months
- (1) 13-18 months
- (2) 19-24 months
- (3) 25-30 months
- (4) 31-36 months
- (5) 37-42 months
- (6) 43-48 months
- (7) Over 48 months

(46) Age child was first bladder trained (parental report):
- (0) Under 12 months
- (1) 13-18 months
- (2) 19-24 months
- (3) 25-30 months
- (4) 31-36 months
- (5) 37-42 months
- (6) 43-48 months
- (7) Over 48 months

(47) Age child first fed self (parental report):
- (0) Under 6 months
- (1) 6-12 months
- (2) 13-18 months
- (3) 19-24 months
- (4) 25-30 months
- (5) 31-36 months
- (6) Over 36 months

(48) Age child first dressed self (parental report):
- (0) Under 24 months

**(48) Age child first dressed self (Continued)**

(1) 25-30 months
(2) 31-36 months
(3) 37-42 months
(4) 43-48 months
(5) 49-54 months
(6) 55-60 months
(7) Over 60 months

**(49) Nocturnal Enureses (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(50) Feeding Problem (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(51) Sleeping Problem (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(52) Destructiveness (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(53) Head Banging (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(54) Body Rocking (parental report):**

(0) None
(1) Mild
(2) Moderate
(3) Severe

**(55) Temper Tantrums (parental report):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(56) Hyperactivity (parental report):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(57) Negativism (parental report):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(58) Sibling Rivalry (parental report):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(59) Gross Motor Problem, including locomotor and balance problems (medical reports):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(60) Fine Motor Problem, (including prehension problem, asteriognosis, etc.) (medical reports):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

**(61) Perceptual disturbance (psychologic report):**
- (0) None
- (1) Mild
- (2) Moderate
- (3) Severe

(62) I.Q. (psychologic report):
- (0) Not testable
- (1) 50-60
- (2) 61-70
- (3) 71-80
- (4) 81-90
- (5) 91-100
- (6) Above 101

(63) Social Quotient (psychologic report):
- (0) Not reported
- (1) Below 50
- (2) 50-60
- (3) 61-70
- (4) 71-80
- (5) 81-90
- (6) 91-100
- (7) Above 101

(64) Estimation of Hearing Loss in the speech range (audiologic reports):
- (0) None
- (1) Mild: 20 db loss or less
- (2) Moderate: 20-50 db loss
- (3) Severe: 50 or more db loss

(65) Speech classification (speech evaluation reports):
- (0) No speech
- (1) Delayed speech
- (2) Articulation disorder (severe)
- (3) Articulation disorder (moderate)
- (4) Articulation disorder (mild)

(66) Estimation of level of expressive language (language evaluation reports):
- (0) None
- (1) Primitive vocalization
- (2) Babbling (some meaning)
- (3) Babbling (with meaning)
- (4) Jargon
- (5) Echolalia
- (6) Single words
- (7) Simple phrases
- (8) Short sentences

(66) Estimation of level of expressive language (Continued)

- (9) Adequate expressive language

(67) Estimation of level of receptive language (language evaluation reports):

- (0) None
- (1) Responds to sudden sounds only
- (2) Responds to vocal commands periodically
- (3) Responds to vocal commands consistently, but not always accurately
- (4) Adequate receptive language

(68) Method of communicating needs (language evaluation reports):

- (0) No attempt
- (1) Random gesture (not understandable)
- (2) Generalized gesture (tugging-pulling)
- (3) Specific gesture (pointing, etc.)
- (4) Single words plus gesture
- (5) Adequate communication

(69) Developmental level of speech (speech evaluation reports):

- (0) Problem not so severe as delayed speech
- (1) Delayed speech (mild)
- (2) Delayed speech (moderate)
- (3) Delayed speech (severe)
- (4) Problem more severe than delayed speech

(70) Acceptability of articulation of sounds (speech evaluation reports):

- (0) Articulation disorder (mild)
- (1) Articulation disorder (moderate)
- (2) Articulation disorder (severe)
- (3) Speech problem more severe than articulation disorder

(71) Progress in therapy (therapy reports):

- (0) None scheduled
- (1) Not recordable
- (2) None recognized
- (3) Poor
- (4) Fair
- (5) Adequate
- (6) Good

(72) Classification of child's speech (parental reports):
- (0) No speech
- (1) Very little speech
- (2) Single words only
- (3) Simple sentences
- (4) Complex sentences

(73) Description of speech (parental reports):
- (0) Delayed speech development
- (1) Severe articulation problem
- (2) Moderate articulation problem
- (3) Mild articulation problem
- (4) No speech problem

(74) Child's ability to communicate (parental report):
- (0) Poor
- (1) Fair
- (2) Average
- (3) Good
- (4) Excellent

(75) Description of child's use of speech (parental reports):
- (0) Does not use speech for communication
- (1) Talks very little but uses gestures
- (2) Volunteers speech in a social situation although some sounds may be defective
- (3) Enjoys talking and speech is understandable
- (4) Talks more than other children of the same age

(76) Classification of child's intelligence (parental reports):
- (0) Severely retarded
- (1) Retarded to some degree
- (2) Average
- (3) Somewhat above average
- (4) Superior

(77) Speech classification prior to speech examination (parental reports):
- (0) No speech
- (1) Single words
- (2) Phrases
- (3) Simple sentences
- (4) Complex sentences

(78) Child's progress in speech (parental reports):

- (0) None
- (1) Some
- (2) Adequate
- (3) Very good
- (4) Excellent

## Appendix B

## Language Evaluation Record Form

NAME: ______________________________ TEST DATE: ____________
ADDRESS: ___________________________ BIRTHDATE: ____________
___________________________ AGE: ____________
PARENTS OCCUPATION: ________________________________________
REFERRED BY: ______________________________________________
REASON FOR REFERRAL: _______________________________________

### (A) Generalized Motor Function

(1) Cerebral dominance: (3x's trial)
__________ 1. Handedness __________ __________ __________
__________ 2. Footedness __________ __________ __________
__________ 3. Eyedness __________ __________ __________

(2) Balance:
__________ 1. Walking rail ______________________________
__________ 2. Romberg: (Sway: front-back; right-left) ______
________________________________________________________

(3) Locomotor:
__________ 1. Gait (clumsy, toe-walking, cogwheel)
__________ 2. Stance (wide based, restricted)
__________ 3. Speed (too slow, too fast)
__________ 4. Range (restricted, overflow)
__________ 5. Imbalance (athetosis, vestibular, ataxia, balance problem)
__________ 6. Motor dysfunction (paralysis, hemiplegia)

(4) Manual Dexterity:
__________ 1. Prehension (index-thumb, middle finger-thumb, palming)
__________ 2. Grasping (tight, loose)
__________ 3. Pointing (generalized, specific)
__________ 4. Writing (imitation, copy, dictation)
__________ 5. Pressure (heavy, light)
__________ 6. Grip (left - right - mixed)

(5) Psychomotor observations:
__________ 1. Tremors (hands, head, trunk)
__________ 2. Asteriognosis (hand-eye, foot-eye)
__________ 3. Overflow (tongue, hands, mouth, head)
__________ 4. Reversals (numbers, letters, words)
__________ 5. Inversions (numbers, letters, words)
__________ 6. Visual problems (blinking, nystagmus, strabismus)
__________ 7. Tics (head, mouth, eyes)
__________ 8. Tapping (foot, hands, fingers)

(B) Speech Motor Function

(1) Description of oral cavity: ______________________________

(2) Motor function of the tongue:
Lateral ____________ Forward __________ Lift ___________

(3) Description of articulation:
__________ 1. Jargon
__________ 2. Echolalia
__________ 3. Substitution of sounds
__________ 4. Omission of sounds
__________ 5. Distortion of sounds
__________ 6. Severe disorder
__________ 7. Moderate disorder
__________ 8. Mild disorder

(4) Description of voice:
__________ 1. Pitch variation
__________ 2. Volume
__________ 3. Rate
__________ 4. Rhythm
__________ 5. Sustainment

(C) Visual Motor Function

(1) Form Boards: _________________ P.A. ____________________

______________________________________________________

Description of visual motor behavior:
__________ 1. Unable to perform
__________ 2. Trial and error placement

Description of visual motor behavior (continued)

_________ 3. Uses left hand primarily
_________ 4. Turns recess around before placement
_________ 5. Fits pieces together before placement
_________ 6. Requests help in placement
_________ 7. Talks or vocalizes while working
_________ 8. Appears disinterested in performance
_________ 9. Recognizes incorrect placements

(2) Geometric Designs: __________ P. A. ________________

______________________________________________________

Description of visual motor behavior:

_________ 1. Scribbles only
_________ 2. Circle only
_________ 3. Perseveration
_________ 4. Drawing must touch examiner's
_________ 5. Uses left hand
_________ 6. Grasp immature for C.A.
_________ 7. Holds head in unusual position

(3) Draw A Person: _____________ P. A. ________________

______________________________________________________

Description of visual motor behavior:

_________ 1. Drawing shows body concept is developed
_________ 2. Head has all important parts
_________ 3. Is able to identify parts verbally
_________ 4. Pencil lines light
_________ 5. Pencil lines heavy

(4) Writing: ____________________ P. A. ________________

______________________________________________________

Description of visual motor behavior:

_________ 1. Can copy single letters
_________ 2. Can copy single numbers
_________ 3. Can copy series of letters
_________ 4. Can copy series of numbers

Description of visual motor behavior (continued)

__________ 5. Can copy sentences
__________ 6. Can write letters from dictation
__________ 7. Can write numbers from dictation
__________ 8. Can write sentences from dictation
__________ 9. Reversals
__________ 10. Inversions

(D) Auditory Capacities

(1) Auditory acuity: (as reported by audiologic examination)

Left ear ____________________ Right ear ________________

__________________________________________________

(2) Auditory Behavior: (Localization and Discrimination)

(a) Localization:

__________ 1. Can differentiate speakers (L, F, R)
__________ 2. Cannot locate source of sound
__________ 3. Does not attempt to locate source
__________ 4. Is unaware of sound

(b) Imitation:

__________ 1. Can imitate speech sounds
__________ 2. Can imitate volume changes
__________ 3. Can imitate rhythm changes

(E) Mental Capacities

(1) Columbia Mental Maturity Scale:

B.S. _________ M.A. __________ C.A. ________ I.Q. ________

Comments: ________________________________________

__________________________________________________

__________________________________________________

__________________________________________________

(2) Ammons Full Range Vocabulary Test:

Score ____________________ M. A. ____________________

Description of behavior: __________________________________

____________________________________________________

____________________________________________________

____________________________________________________

## Summary

1. Motor Function: __________________________________
2. Speech Performance: ______________________________
3. Visual Performance: ______________________________
4. Auditory Behavior: _______________________________
5. Mental Capacities: _______________________________

# APPENDIX C

## Explanation of Record Form I:

## History and Test Data

I. Identification items, source of referral, recommended procedures, and summary:

A. Space is provided on the card for recording: child's name, parents' name, parents' occupation, other speech problems in family, parents' ages and number of years married, phone number; birthdate, age, sex, race, case number, and admission date of child. Space is also available for recording the names, ages, developmental sequences, and estimated intelligence of siblings.

B. For clinical use, specifics concerning the referral agencies and recommended procedures are also indicated on the card; also, a section for summary, classification of problem, etiology, degree of involvement and disposition of the case.

II. Prenatal history; obtained from medical records or reports;

A. Space is provided on the card for recording: miscarriages, Rh incompatibility, nausea, hemorrhage, toxemia, maternal emotional tension, condition similar to child's in same family, and maternal accidents.

B. Punch 9 was used to indicate that no prenatal problem was reported; punches 10 and 11 were used to indicate that problems other than those listed on the card were present and the problems were written on the card.

III. Birth or neonatal history items; obtained from medical records or reports:

A. Space is provided on the card for recording information concerning the presentation, delivery, hours in labor, and condition of child at birth. Presentation: cephalic, breech, other; Delivery: instruments used, caesarean, cord prolapse, anesthesia used (excessive), other delivery problems; Labor: precipitate (3 hours or less), prolonged (18 hours or more), induction; Conditions: anoxia, kernicterus, anomalies, convulsions (at or soon following birth), cyanosis, premature (5 pounds or less).

B. The punch other was used to indicate post term (birth weight of 9.5 pounds or more).

IV. Postnatal history; obtained from medical records or reports:

A. Space is provided on the card for recording: colic, eczema, asthma, orthopedic problem, strabismus, febrile episodes, meningitis, encephalitis, surgery and convulsions.

B. The punch indicating other under postnatal history was used to record other conditions or diseases, the specifics of which were written on the card.

V. Behavior history; as reported by parents or informant:

A. Space is provided on the card for recording: enuresis (night and day), feeding problems, sleeping problems, destructiveness, head banging, body rocking, change in behavior following illness, temper tantrums, hyperactivity, negativism, sibling rivalry, gross motor problem, fine motor problem, perseveration, and immaturity.

B. No item was punched if there was evidence that the parent did not understand the meaning of the term even after explanation. For this reason, items labeled perceptual disorder (visual), and perceptual disorder (auditory), were omitted from this study.

VI. Information obtained from specific test procedures:

A. Space is provided on the card for recording information resulting from the following examinations: pediatric, neurologic, psychiatric, psychologic, audiologic, speech and language.

1. Pediatric examination was completed for all children using the following possible categories:

   a. organic (evidence of central nervous system involvement).

b. anomalous (evidence of irregular physical development).

c. endocrine disorder (evidence of endocrine malfunction).

d. not differentiated (evidence of a possible physical problem but not classifiable at the time of examination).

e. no apparent problem.

2. Neurologic examination was completed for those children examined upon referral only:

a. Electroencephalographic studies.

(1) yes (referred for study and examined)
(2) pos. (results are positive)

b. Pneumoencephalographic studies.

(1) yes (referred for study and examined)
(2) pos. (results are positive)

c. X-rays.

(1) yes (referred for study and examined)
(2) pos. (results are positive)

3. Psychiatric examination was completed for those children examined upon referral only:

a. results of psychiatric referral:

(1) yes ( a severe emotional problem exists)
(2) possible (it is possible that an emotional problem exists; further study is necessary)

b. results of parental consultation:

(1) yes (one or both parents have emotional problems and should have psychiatric attention)

(2) possible (it is possible that parents have emotional problems and further consideration of problems is necessary)

c. results of examination suggest agency referral:

(1) yes (referral to hospital or clinic for total psychiatric workup of both child and parents)

(2) possible (possible total psychiatric workup is needed for parents and child, but further study indicated before referral is made)

4. Psychologic examination completed for all children and recorded as follows:

a. Space is provided on the card for recording the date of testing, chronological age, mental age, intelligence quotient, and tests used.

b. Space is also provided for recording developmental items such as time of first sitting, walking, talking words, talking sentences, toilet training, feeding self, and dressing self.

5. Audiologic examination was completed for those children examined upon referral only:

a. Space is provided for recording: hearing loss present (an average binaural loss of 30 decibels or more in the speech range); hearing aid fitted; and auditory training recommended.

b. The punch other is used to indicate that the child was tested but no hearing loss was found.

6. Speech and language evaluation completed for all children and recorded as follows:

a. Behavior during test procedures:

(1) attention span short: the inability of the child to attend to a task sufficiently long for completion or scoring of item.

(2) hyperactive: a problem of inattention more severe than short attention span; includes body activity to the point that child is not tractable.

(3) separation problem: difficulty in separating child from parent or attendant.

(4) perseveration: evidence on several tasks that child continues performance past the necessary required activity.

(5) lack of contact: child is either constantly or periodically out of contact with his environment.

(6) poor emotional tone: child does not laugh, smile or cry appropriately; may be in contact with surroundings but may have facial mask or inappropriate emotional behavior.

(7) no localization of sound: unable to localize the source of sound accurately although the child may give evidence of awareness of sound itself.

(8) asteriognosis: evidence of inability to recognize objects or forms by touch, or the apparent need for more than normal reenforcement of tactual stimuli for identification.

(9) drooling: evidence of inability to control excretion of salivary glands to an extreme degree.

(10) tremors: usually intention tremors as observed during testing; sometimes intermittent or muscular tremors.

(11) visual-motor problem: indication that difficulty is present in eye-hand coordination observed in writing, completion of form boards, drawing, etc.

(12) destructiveness: aggressively attacks and attempts to destroy materials on either an intentional or non-intentional basis.

(13) aggressiveness: attempts to attack examiner or materials in the test room or the general environment.

(14) comprehension problem: indication that the child does not comprehend certain instructions during the test situation that are in range of his mental age.

b. Results of specific tests:

(1) Geometric Design duplication:
   (a) level of child's ability to complete geometric designs after watching the examiner draw the design and with the copy before him.
   (b) if child is able to draw geometric designs at a more complicated level than those used for evaluation, the item labeled oth. (for other) is punched.

(2) Form Boards:
   (a) if child is able to complete form-boards considered to be at his general chronological age level, the item Form Boards Adequate is punched.
   (b) if child is unable to complete form boards at this general age level, for any reason, the item Form Boards Adequate is not punched.

(3) Picture Identification:
   (a) simple straight line drawings are presented and the method child used

for identification, if correct, is indicated by: points, gestures, or names.

(b) if child is unable to accurately identify pictures, no punch is made.

(4) Speech Classification:

(a) if child has no speech or a delay in speech and language development, the problem is indicated as: none, delayed speech (at the single word, phrase, or sentence level), jargon, or echolalia.

(b) if child has speech, but it is dysarticulated, he is classified as having omissions, substitutions, or distortions of sounds, or some combination of these.

(5) Language Classification:

(a) if child has a primary receptive language disorder, yes under receptive language disorder is punched; if a receptive language disorder is suspected, but the child is not testable, then, N. T. is punched.

(b) if child has a primary expressive language disorder, yes under expressive language disorder is punched; if an expressive language disorder is suspected but the child is not testable, then, N. T. is punched.

(c) the item inner language disorder was not used in this study.

(d) specific classifications of aphasia, alexia, agraphia, and acalculia were provided on the card, but not used in this study.

# Appendix D

## Explanation of Record Form 2: History and Test Data

(Items are numbered as they appear on Record Form 2)

I. History and Informational Items:

A. The first 64 items on this form were also contained on Record Form 1 (See Appendix C).

B. Informational items concerned with identification, birthweight, age, sex, acceptance for therapy, and developmental schedule are recorded in the center of the card.

C. Items 81 through 87 were used for classification of problems.

II. Observation During Psychologic Examination:

A. The following aspects of behavior were observed during Psychologic testing; if a problem was present the item was punched on the record form.

88. Appearance: an assessment of the child's general appearance which suggested the type of care which the child received at home.

89. Ability to separate from parents: (Same as Record Form 1).

90. Approach to Test: a problem was considered present if the child had to be persuaded repeatedly to participate in test procedures.

91. Attention: (same as Attention Span on Record Form 1)

92. Non-Verbal Comprehension: a problem was considered present when the child was unable to perform on non-verbal items.

93. Verbal Comprehension: a problem was considered present when the child was unable to follow or understand verbal requests for performance.

94. Lip Reading: assessment of ability to follow directions given without voice. (included only for clinical study and excluded from further consideration in this study).

95. Cooperation: inherent in this term was the aspect of Negativism on Record Form 1.

96. Stability: a factor that was considered opposite of hyper-activity, temper tantrums, and random movement as on Record Form 1.

97. Dependency: a need for the child to obtain help from the examiner in order to perform on test items considered to be well within the realm of the child's abilities.

98. Hostility: evidence of "acted out" hostility of the child toward parents, examiner, the test situation, or any combination of these.

99. Affect: the term "affect" was used to summarize the

emotional Gestalt of the child during test procedures. (same as Emotional Tone, Record Form 1)

100. Perseverance: not to be confused with perseveration; this term was used to indicate the opposite of "giving up" before completion of a task.

101. Checks Work: used to indicate a careful and conscientious worker in terms of test completion.

102. Trial and Error: (same as Trial and Error on Record Form 1).

103. Deliberation: this term was selected to indicate careful consideration of all facets of a task before attempting to complete it.

104. Systematic: used to indicate careful organization prior to and during performance on test items.

105. Awareness-Successness: used to indicate that the child was aware of and adjusted to both his abilities and limitations in performance on test items.

106. Coordination: Finger-Hand: (same as Prehension on Record Form 1).

107. Hand Coordination: Coordination of hand as a unit in activities not involving prehension.

108. Eye-Hand Coordination: (same as Visual-Motor Coordination on Record Form 1).

109. Articulation: (same as on Record Form 1).

110. Jargon: (same as on Record Form 1).

111. Verbal Communication: (same as level of Speech Development (Delayed Speech) on Record Form 1).

112. Imitation of Gesture: ability to imitate gestures of examiner when asked to do so.

113. Echolalia: (same as on Record Form 1).

114. Attention to Minutiae: over concern with details to the exclusion of the Gestalt.

115. Final Reaction to Test: attempt to assess reaction to test situation (as compared subjectively with the general population) in terms of the extent of relief or regret that the testing session was terminated.

116. General Rapport: assessment of rapport established between child and examiner during test procedures.

III. Judgment of Relationships: (Item 65)

A. Items 65 through 74 were scored passed or failed on the basis of two out of three attempts, and administered by the examiner in the test room with the child.

66. Size: the examiner draws two circles and asks the child "Which is larger; which is smaller?" Child responds by pointing.

67. Distance: the examiner places two objects in front of the child; one closer to the child than the other; and asks: "Which is closer; which is farther?" Child responds by selecting an object.

68. Direction: examiner asks the child: "Where is up; down; right; left; above; below; back; front?" Child responds by pointing.

69. Weight: the examiner gives the child two identical objects that differ only in weight and asks the child: "Which is heavier; which is lighter?"

70. Volume: examiner shows the child two cups; one is filled, one is not and asks: "Which is empty; which is full?"

71. Speed: examiner asks the child: "Which is faster, an airplane or an automobile; an airplane or a horse; a bicycle or a train?" If child has no speech, pictures are used for selection.

72. Length: examiner draws two lines and asks the child: Which is longer; which is shorter?" Child responds by pointing.

73. Time: the examiner asks: "Which is later, morning or evening; afternoon or evening; morning or night?"

74. Height: examiner shows the child pictures of buildings and people and asks: "which is taller; which is shorter?"

B. Items 75 through 80 were scored passed or failed on the basis of two out of three attempts, and administered by the examiner in the control room through the three directional speakers in the test room where the child was seated.

75. Size (R): "Which is larger, a penny or a nickel; an apple or a dog; a boy or a horse?"

76. Direction (R): "Hold up your left hand; your right thumb."

77. Weight (R): "Which is heavier; a boy or a horse; a dog or a house; a cat or a T.V. set?"

78. Speed (R): "Which is faster: a wagon or an airplane; a dog or a horse; a boy or a bird?

79. Time (R): (same questions asked about time by other examiner).

80. Height (R): "Which is taller (bigger), you or your mother; you or your father; a building or you?"

IV. Observations and Clinical Classification of Problems During Therapy:

A. The following aspects of behavior and clinical classifications were recorded by the Therapist during therapy and if a problem was found to be present the item was punched on the record form.

117. Receptive Language: indicating a primary problem in Receptive Language.

118. Expressive Language: indicating a primary problem in

Expressive Language. (N. B. If both Receptive and Expressive Language problems were present, both 117 and 118 were punched).

119. Behavior: any problem in behavior that consistently interrupted or precluded maximum benefits from therapy.

120. Number Concepts: inability or limited ability to work adequately with number concepts commensurate with chronological age.

121. Color Concepts: inability or limited ability to recognize and accurately identify colors within range of chronological age expectancy.

122. Figure-Ground Disturbance: inability to differentiate between the figure and the background, as observed in visual performance only.

123. Visual-Motor Problem: (same as on Record Form 1).

124. Imitation: inability to imitate the therapist in particular acts such as tongue movements, social actions, etc. when requested to do so.

125. Drawing: inability to reproduce therapist's drawings or designs during therapy sessions when requested to do so.

126. Educational Potential: estimated in terms of child's possible acceptance in regular classrooms of the public school.

127. Therapeutic Emphasis: indication of sensory pathways considered best for remedial plans. (Included only for clinical consideration but excluded as an isolated item from this study).

128. Perceptual Performance: estimation of whether or not a Perceptual Disturbance was diminishing the maximum effects of therapy. (Included only for clinical consideration but excluded as an isolated item from this study).

V. Use of Grids for Recording Data:

A. Method Used in Recording: The grids on Record Form 2 were triangular-shaped units containing numbers. The appropriate number was recorded by punching the hole or holes representing the convergence point of the two columns where the number was indicated. (e.g. The grid used to record birthweight has six possible selections and four holes. If number four was to be indicated, the two outside columns were followed from the apex of the triangle to the base and the two outer holes were punched)

B. Type of Information Recorded on Grids: Grids were used to record continuous data, and on Record Form 2 provision was made for recording the Child's I.Q., Parent's I.Q., Child's Social Maturity Score, and birth weight. Two other grids (one containing 15 units and the other 10 units) were used in this study to record results of parental tests.

### Table 1

### Distribution of Primary Classification of Causal Factors for Delayed Speech and Language Development

(Total 1200 Group)

| Classification | N | % |
|---|---|---|
| Hearing Loss | 124 | 10 |
| Mental Retardation | 167 | 14 |
| Emotional Disturbance | 82 | 7 |
| Environmental Factor | 224 | 19 |
| Delayed Development | 91 | 7 |
| Language Disorder | 49 | 4 |
| Multiple Problems | 115 | 10 |
| Not Classified | 348 | 29 |

## Table 2

### Distribution of Primary Classification of Causal Factors for Delayed Speech and Language Development

(Previously Unclassified Group)

| Classification | N | % |
|---|---|---|
| Hearing Loss | 23 | 10 |
| Mental Retardation | 50 | 21 |
| Emotional Disturbance | 52 | 22 |
| Language Disorder | 90 | 37 |
| Multiple Problems | 14 | 6 |
| Still Unclassified | 10 | 4 |

Table 3

Possible Loadings for Factors I and II

(Previously Unclassified Group)

| No.* | Factor I | | No.* | Factor II | | No.* | Factor II | |
|---|---|---|---|---|---|---|---|---|
| 16 | P.E.G. | -.75 | 44 | Talked Sentences | .71 | 61 | Perceptual Problems | .36 |
| 2 | Meningitis | -.65 | 72 | Speech Classification | -.71 | 42 | Walked Alone | .36 |
| 14 | Anomalies | -.45 | 68 | Method Communication | -.67 | 46 | Bladder Training | .35 |
| 4 | Family Speech Problem | -.40 | 9 | Comprehension Prob. | .60 | 45 | Bowel Training | .34 |
| 18 | Environmental Change | -.40 | 11 | Short Attention Span | .53 | 41 | Sat Alone | .33 |
| 11 | Short Attention Span | .38 | 74 | Ability to Communicate | -.51 | 60 | Fine Motor Problem | .32 |
| 13 | C.N.S. Involvement | .36 | 77 | Speech Classification | -.51 | 3 | Encephalitis | .30 |
| 6 | Perseveration | .32 | 16 | P.E.G. | .49 | 7 | Visual-Motor Prob. | .30 |
| 20 | Surgery | .31 | 66 | Expressive Language | -.49 | 48 | Dressed Self | .29 |
| 48 | Dressed Self | .31 | 67 | Receptive Language | -.44 | 49 | Enuresis (Night) | .28 |
| 46 | Bladder Training | .31 | 43 | Talked Words | .43 | 12 | Potential I.Q. | .27 |
| 45 | Bowel Training | .26 | 10 | Immaturity | .43 | 52 | Destructiveness | .27 |
| 12 | Potential I.Q. | -.26 | 69 | Speech Devl. Level | .41 | 54 | Body Rocking | .26 |
| 9 | Comprehension Prob. | .26 | 5 | Change After Illness | .41 | 13 | C.N.S. | .26 |
| 32 | Incubator | .25 | 17 | Drugs Used | .41 | 63 | S.Q. | .25 |
| 28 | Emotional Tension | .24 | 59 | Gross Motor Problem | .40 | 70 | Artic. Acceptability | .24 |
| 8 | Developmental Lag | -.24 | 71 | Progress in Therapy | -.39 | 53 | Head Banging | .24 |
| 42 | Walked Alone | .24 | 19 | Speech Therapy | .39 | 56 | Hyperactivity | .22 |
| 59 | Gross Motor Problem | .22 | 62 | I.Q. | -.38 | 55 | Temper Tantrums | .20 |
| 60 | Fine Motor Problem | .22 | 47 | Fed Self | .38 | 57 | Negativism | .19 |
| 62 | I.Q. | -.22 | | | | | | |
| 10 | Immaturity | .21 | | | | | | |

* No. = Number of Item as listed in Appendix A.

## Table 4

## Continuous Variables in the

## Total $\overline{503}$ Group

| VARIABLES | N | Mean | S. D. | Information Not Available | | Not Yet Performing or Not Testable | |
|---|---|---|---|---|---|---|---|
| | | | | N | % | N | % |
| Sat Alone (in months) | 470 | 7.068 | 2.416 | 33 | 6.6 | - | - |
| Walked Alone (in months) | 480 | 14.298 | 4.606 | 23 | 4.6 | - | - |
| Talked Words (in months) | 388 | 27.580 | 11.860 | 53 | 10.5 | 62 | 12.3 |
| Talked Sentences (in months) | 275 | 37.778 | 11.958 | 81 | 16.1 | 147 | 29.2 |
| Bowel Training (in months) | 416 | 27.639 | 9.274 | 50 | 9.9 | 37 | 7.4 |
| Bladder Training (in months) | 424 | 27.976 | 9.215 | 47 | 9.3 | 32 | 6.4 |
| Fed Self (in months) | 423 | 17.596 | 7.395 | 58 | 11.5 | 22 | 4.4 |
| Dressed Self (in months) | 282 | 39.021 | 9.556 | 117 | 23.3 | 104 | 20.7 |
| Mother's Age (in years) | 395 | 28.471 | 5.749 | 8 | 1.6 | - | - |
| Father's Age (in years) | 394 | 31.277 | 6.387 | 9 | 1.8 | - | - |
| Child's Age (in months) | 503 | 61.076 | 20.181 | - | - | - | - |
| Birth Weight (in ounces) | 475 | 109.891 | 23.080 | 28 | 5.6 | - | - |
| Tested I.Q. | 443 | 84.386 | 19.116 | 3 | 0.6 | 57 | 11.3 |
| Estimated Potential I. Q. | 444 | 92.635 | 17.980 | 2 | 0.4 | 57 | 11.3 |

### Table 5

### Single Dichotomous Variables

### in the Total 503 Group

### (Race, Sex and Socio-Economic Status)

| Variables | N | % |
|---|---|---|
| Race | | |
| Negro | 63 | 12.52 |
| White | 440 | 87.48 |
| Sex | | |
| Male | 351 | 69.78 |
| Female | 152 | 30.22 |
| Socio-Economic Status | | |
| Professional | | |
| $10,000 and up | 35 | 6.96 |
| White Collar | | |
| $7,500 to $10,000 | 107 | 21.27 |
| Skilled | | |
| $5,000 to $7,500 | 115 | 22.86 |
| Semi-Skilled | | |
| $3,000 to $5,000 | 153 | 30.42 |
| Laborer | | |
| $1,000 to $3,000 | 23 | 4.57 |
| Unemployed | | |
| --- | 28 | 5.57 |
| Unknown | | |
| --- | 42 | 8.35 |

Table 6

Single Dichotomous Variables

in the Total $\overline{503}$ Group

(Prenatal History Items)

| Prenatal History Items | N | % |
|---|---|---|
| Miscarriages | 100 | 19.88 |
| Rh Incompatibility | 45 | 8.95 |
| Nausea | 56 | 11.13 |
| Hemorrhage | 62 | 12.33 |
| Toxemia | 12 | 2.39 |
| Emotional Tension | 37 | 7.36 |
| Familial Problems | 7 | 1.39 |
| Accidents | 22 | 4.37 |
| Other Problems | 21 | 4.17 |
| No Problems | 249 | 49.50 |

## Table 7

## Single Dichotomous Variables

## in the Total $\overline{503}$ Group

## (Birth and Neonatal History Items)

| Birth and Neonatal History Items | N | % |
|---|---|---|
| Cephalic Presentation | 452 | 89.86 |
| Breech Presentation | 23 | 4.57 |
| Caesarian Section | 28 | 5.57 |
| Instruments Used | 61 | 12.13 |
| Cord Prolapse | 7 | 1.39 |
| Anaesthesia Used | 324 | 64.41 |
| Other Delivery Problems | 104 | 20.68 |
| Precipitate Labor | 44 | 8.75 |
| Prolonged Labor | 43 | 8.55 |
| Induced Labor | 39 | 7.75 |
| Anoxia | 62 | 12.33 |
| Kernicterus | 25 | 4.97 |
| Anomalies | 43 | 8.55 |
| Convulsions | 17 | 3.38 |
| Cyanosis | 30 | 5.96 |
| Prematurity | 33 | 6.56 |
| Postmaturity | 17 | 3.38 |

## Table 8

## Single Dichotomous Variables

## in the Total $\overline{503}$ Group

## (Postnatal History Items)

| Postnatal History Items | N | % |
|---|---|---|
| Colic | 34 | 6.76 |
| Eczema | 19 | 3.78 |
| Asthma | 11 | 2.19 |
| Orthopedic Problems | 17 | 3.38 |
| Strabismus | 35 | 6.96 |
| Febrile Episodes | 124 | 24.65 |
| Meningitis | 2 | 0.40 |
| Encephalitis | 5 | 0.99 |
| Surgery | 99 | 19.68 |
| Convulsions | 51 | 10.14 |
| Other Problems | 34 | 6.76 |

## Table 9

## Single Dichotomous Variables

## in the Total $\overline{503}$ Group

## (Medical Diagnoses)

| Medical Diagnoses | N | % |
|---|---|---|
| Organicity | 212 | 42.15 |
| Anomalies | 31 | 6.16 |
| Endocrine Disorders | 1 | 0.20 |
| Undifferentiated Problems | 200 | 39.76 |
| No Apparent Problem | 65 | 12.92 |

## Table 10

### Single Dichotomous Variables

### in the Total $\overline{503}$ Group

### (Behavior Problems Reported by Parents)

| Behavior Problems Reported by Parents | N | % |
|---|---|---|
| Enuresis (night) | 61 | 12.13 |
| Enuresis (day) | 17 | 3.38 |
| Feeding Problems | 38 | 7.55 |
| Sleeping Problems | 28 | 5.57 |
| Destructiveness | 40 | 7.95 |
| Head Banging | 31 | 6.16 |
| Body Rocking | 48 | 9.54 |
| Behavior Change Following Illness | 15 | 2.98 |
| Temper Tantrums | 86 | 17.10 |
| Hyperactivity | 135 | 26.84 |
| Negativism | 57 | 11.33 |
| Sibling Rivalry | 41 | 8.15 |
| Motor Problem (Gross) | 112 | 22.27 |
| Motor Problem (Fine) | 117 | 23.26 |
| Perseveration | 3 | 0.60 |
| Immaturity | 93 | 18.49 |

## Table 11

## Single Dichotomous Variables

## in the Total $\overline{503}$ Group

## (Behavior Problems Reported by Examiners)

| Behavior Problems Reported by Examiners | N | % |
|---|---|---|
| Short Attention Span | 161 | 32.01 |
| Hyperactivity | 109 | 21.66 |
| Separation Problem | 56 | 11.13 |
| Perseveration | 33 | 6.56 |
| Lack of Contact | 47 | 9.34 |
| Poor Emotional Tone | 52 | 10.34 |
| No Localization of Sound | 140 | 27.83 |
| Asteriognosis | 121 | 24.06 |
| Drooling | 50 | 9.94 |
| Tremors | 173 | 34.39 |
| Visual-Motor Problem | 179 | 35.59 |
| Destructiveness | 13 | 2.58 |
| Aggressiveness | 16 | 3.18 |
| Comprehension Problem | 303 | 60.24 |

## Table 12

## Single Dichotomous Variables

## in the Total 503 Group

## (Objective Test Items)

| Objective Test Items | N | % |
|---|---|---|
| Form Board Passed | 149 | 29.62 |
| Geometric Design Passed | 121 | 24.06 |
| Pictures Identified by: | | |
| Pointing | 68 | 13.52 |
| Gesturing | 8 | 1.59 |
| Naming | 183 | 36.38 |
| Unable to Identify | 244 | 48.51 |

### Table 13

### Single Dichotomous Variables

### in the Total $\overline{503}$ Group

### (Speech Classifications)

| Speech Level | N | % |
|---|---|---|
| No Speech | 87 | 17.3 |
| Delayed Speech | 216 | 42.9 |
| (Single Words) | (78) | (36.1) |
| (Phrases) | (97) | (44.9) |
| (Sentences) | (41) | (19.0) |
| Jargon | 33 | 6.6 |
| Echolalia | 23 | 4.6 |
| Articulation Disorders | 140 | 27.8 |
| *(Omissions) | (39) | (27.9) |
| *(Substitutions) | (112) | (80.0) |
| *(Distortions) | (39) | (27.9) |
| No Speech Problem | 4 | 0.8 |

* These items are not mutually exclusive, since any child may have had more than one type of articulation disorder.

## Table 14

## Combined Dichotomous Variables

## in the Total 503 Group

| Combined Variables | N | % |
|---|---|---|
| Prenatal History Problems | 254 | 50.50 |
| Birth Presentation Problems | 51 | 10.14 |
| Neonatal Problems | 80 | 15.90 |
| Delivery Problems | 462 | 91.85 |
| History Items: (reported by parents) | | |
| Postnatal Problems | 58 | 11.53 |
| Possible Organic Problems | 94 | 18.69 |
| High Temperature Diseases | 127 | 25.25 |
| Surgery | 99 | 19.68 |
| Medical Problems | 438 | 87.08 |
| Behavior Problems: (reported by parents) | | |
| Possible Psychoneurotic Behavior | 259 | 51.49 |
| Possible Psychomotor Disturbance | 60 | 11.93 |
| Possible Organic Behavior | 266 | 52.88 |

## Table 15

### Diagnostic Categories of Total $\overline{503}$ Group

| Category | N | % | Abbreviation |
|---|---|---|---|
| Language Disorder | 177 | 35.2 | L/D |
| Emotional Disturbance | 88 | 17.5 | E/D |
| Mental Retardation | 104 | 20.6 | M/R |
| Hearing Loss | 29 | 5.8 | H/L |
| Articulation Disorder | 46 | 9.1 | A/D |
| Immature Behavior | 31 | 6.2 | I/B |
| Not Differentiated | 28 | 5.6 | N/D |
| Totals | 503 | 100.0 | --- |

## Table 16

### Comparison of the Continuous Variables Among the Seven Diagnostic Categories of the Total 503 Group

### (Locomotion Variables)

| Diagnostic Categories of the 503 Group | Total N for Each Group | Locomotion Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sat Alone (in months) | | | | | Walked Alone (in months) | | | | |
| | | N | Mean | S.D. | U* | N.P.* | N | Mean | S.D. | U* | N.P.* |
| Language Disorder | (177) | 169 | 7.142 | 2.354 | 8 | - | 172 | 14.180 | 4.062 | 5 | - |
| Mental Retardation | (104) | 91 | 8.110 | 2.735 | 13 | - | 95 | 17.105 | 5.891 | 9 | - |
| Emotional Disturbance | (88) | 85 | 6.506 | 1.968 | 3 | - | 86 | 13.140 | 3.891 | 2 | - |
| Hearing Loss | (29) | 27 | 6.926 | 1.884 | 2 | - | 27 | 13.667 | 4.884 | 2 | - |
| Articulation Disorder | (46) | 43 | 6.442 | 1.688 | 3 | - | 44 | 12.795 | 2.896 | 2 | - |
| Immature Behavior | (31) | 30 | 5.967 | 1.169 | 1 | - | 30 | 12.167 | 2.570 | 1 | - |
| Not Differentiated | (28) | 25 | 7.240 | 3.771 | 3 | - | 26 | 14.308 | 4.027 | 2 | - |
| Chi-Square Value and probability of Bartlett's Homogeneity of Variance Test | | | | | | | | | 47.577<br><.01 | | |

- * U = information unknown
- * NP = Not yet performing

## Table 17

Comparison of the Continuous Variables Among the Seven Diagnostic Categories of the Total 503 Group

(Speech Variables)

| Diagnostic Categories of the 503 Group | Total N for Each Group | Speech Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Talked Words (in months) | | | | | Talked Sentences (in months) | | | | |
| | | N | Mean | S. D. | U* | N. P.* | N | Mean | S. D. | U* | N. P.* |
| Language Disorders | (177) | 137 | 28.007 | 11.683 | 20 | 20 | 99 | 38.980 | 11.203 | 34 | 44 |
| Mental Retardation | (104) | 70 | 32.171 | 14.476 | 17 | 17 | 39 | 44.590 | 13.647 | 22 | 43 |
| Emotional Disturbance | (88) | 72 | 25.542 | 9.400 | 6 | 10 | 50 | 35.140 | 9.749 | 10 | 28 |
| Hearing Loss | (29) | 15 | 32.000 | 15.440 | 4 | 10 | 9 | 47.000 | 10.954 | 4 | 16 |
| Articulation Disorder | (46) | 43 | 21.093 | 8.291 | 2 | 1 | 40 | 31.875 | 10.088 | 3 | 3 |
| Immature Behavior | (31) | 29 | 25.138 | 7.523 | 1 | 1 | 23 | 33.304 | 11.196 | 3 | 5 |
| Not Differentiated | (28) | 22 | 29.864 | 10.636 | 3 | 3 | 15 | 38.000 | 11.337 | 5 | 8 |
| Chi-Square Value and probability of Bartlett's Homegeneity of Variance Test | | | | 31.615<br><.01 | | | | | 6.061<br>>.30 | | |

* U = information unknown

* NP = Not yet performing

## Table 18

### Comparison of the Continuous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Self Help Variables)

| Diagnostic Categories of the $\overline{503}$ Group | Total N for Each Group | Self Help Variables | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bowel Training(in months) | | | | | Bladder Training (in months) | | | | | Feeding Self(in months) | | | | | Dressing Self(in months) | | | | |
| | | N | Mean | S.D. | U* | NP* | N | Mean | S.D. | U | NP | N | Mean | S.D. | U | NP | N | Mean | S.D. | U | NP |
| Language Disorder | (177) | 150 | 27.647 | 8.339 | 17 | 10 | 154 | 27.929 | 8.354 | 14 | 9 | 149 | 16.826 | 7.038 | 19 | 9 | 87 | 38.230 | 8.225 | 56 | 34 |
| Mental Retardation | (104) | 73 | 32.58[illegible] | 12.773 | 16 | 15 | 75 | 32.640 | 12.471 | 17 | 12 | 78 | 21.487 | 9.180 | 19 | 7 | 42 | 46.714 | 13.139 | 26 | 36 |
| Emotional Disturbance | (88) | 77 | 26.753 | 8.264 | 4 | 7 | 77 | 27.208 | 8.052 | 4 | 7 | 76 | 16.382 | 6.048 | 7 | 5 | 53 | 37.226 | 8.311 | 14 | 21 |
| Hearing Loss | (29) | 23 | 26.174 | 8.344 | 6 | - | 24 | 27.042 | 9.356 | 5 | - | 24 | 18,042 | 7.300 | 5 | - | 15 | 37.600 | 5.571 | 8 | 6 |
| Articulation Disorder | (46) | 45 | 25.800 | 6.442 | 1 | - | 45 | 26.133 | 6.448 | 1 | - | 43 | 16.581 | 5.453 | 3 | - | 44 | 38.477 | 8.897 | 2 | - |
| Immature Behavior | (31) | 29 | 24.345 | 5.844 | 1 | 1 | 29 | 25.034 | 6.133 | 1 | 1 | 30 | 16.233 | 6.275 | 1 | - | 26 | 35.500 | 7.412 | 3 | 2 |
| Not Differentiated | (28) | 19 | 23.316 | 72.62 | 5 | 4 | 20 | 23.350 | 7.080 | 5 | 3 | 23 | 16.609 | 7.069 | 4 | 1 | 15 | 37.533 | 5.596 | 8 | 5 |

* U= information unknown
NP= not yet performing
(N)= Total N for each group

## Table 19

### Comparison of the Continuous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Age and Birth Weight Variables)

| Diagnostic Categories of the $\overline{503}$ Group | Total N for Each Group | Age and Birth Weight Variables | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mother's Age(in years) | | | | Father's Age (in years) | | | | Child's Age (in months) | | | | Birth Weight (in ounces) | | | |
| | | N | Mean | S.D. | Un-known | N | Mean | S.D. | Un-known | N | Mean | S.D. | Un-known | N | Mean | S.D. | Un-known |
| Language Disorder | (177) | 139 | 28.029 | 5.352 | 38 | 139 | 30.755 | 6.612 | 38 | 177 | 64.819 | 22.216 | -- | 166 | 109.422 | 24.408 | 11 |
| Mental Retardation | (104) | 73 | 29.301 | 6.902 | 31 | 73 | 32.452 | 7.221 | 31 | 104 | 64.490 | 22.497 | -- | 96 | 106.406 | 23.649 | 8 |
| Emotional Disturbance | (88) | 74 | 28.757 | 5.496 | 14 | 73 | 31.192 | 5.862 | 15 | 88 | 55.705 | 17.936 | -- | 86 | 111.442 | 17.894 | 2 |
| Hearing Loss | (29) | 24 | 27.042 | 4.962 | 5 | 24 | 30.833 | 5.886 | 5 | 29 | 62.828 | 13.996 | -- | 28 | 107.357 | 25.490 | 1 |
| Articulation Disorder | (46) | 36 | 30.139 | 5.508 | 10 | 36 | 32.389 | 5.534 | 10 | 46 | 62.043 | 11.675 | -- | 44 | 108.977 | 21.779 | 2 |
| Immature Behavior | (31) | 27 | 27.667 | 5.312 | 4 | 27 | 31.074 | 6.248 | 4 | 31 | 47.355 | 7.390 | -- | 29 | 116.966 | 23.767 | 2 |
| Not Differentiated | (28) | 22 | 27.364 | 5.381 | 6 | 22 | 29.864 | 4.576 | 6 | 28 | 53.393 | 17.985 | -- | 26 | 117.000 | 22.414 | 2 |

## Table 20

### Comparison of the Continuous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Intelligence Variables)

| Diagnostic Categories of the $\overline{503}$ Group | Total N for Each Group | Intelligence Variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Tested I. Q. | | | | | Estimated Potential I. Q. | | | | |
| | | N | Mean | S. D. | Un-known | Not Testable | N | Mean | S. D. | Un-known | Not Testable |
| Language Disorder | (177) | 177 | 84.322 | 15.933 | -- | -- | 177 | 98.164 | 11.093 | -- | -- |
| Mental Retardation | (104) | 96 | 64.323 | 13.334 | -- | 8 | 96 | 68.062 | 13.409 | -- | 8 |
| Emotional Disturbance | (88) | 58 | 96.017 | 16.904 | -- | 30 | 58 | 101.603 | 14.124 | -- | 30 |
| Hearing Loss | (29) | 21 | 94.905 | 19.743 | 1 | 7 | 22 | 104.909 | 17.911 | -- | 7 |
| Articulation Disorder | (46) | 45 | 101.511 | 10.156 | 1 | -- | 45 | 102.333 | 9.350 | 1 | -- |
| Immature Behavior | (31) | 31 | 95.516 | 8.032 | -- | -- | 31 | 99.129 | 11.653 | -- | -- |
| Not Differentiated | (28) | 15 | 79.467 | 12.285 | 1 | 12 | 15 | 89.467 | 6.692 | 1 | 12 |
| Chi-Square Value and probability of Bartlett's Homogeneity of Variance Test | | | | 15.518<br><.02 | | | | | 27.844<br><.01 | | |

## Table 21

### Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Socio-Economic Status of the Parents)

| Socio-Economic Group | Language Disorder | | Mental Retardation | | Emotional Disturbance | | Hearing Loss | | Articulation Disorder | | Immature Behavior | | Not Differentiated | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Professional<br>$10,000 and up | 14 | 7.9 | 5 | 4.8 | 4 | 4.5 | 1 | 3.4 | 4 | 8.7 | 4 | 12.9 | 3 | 10.7 |
| White Collar<br>$7,500 to $10,000 | 45 | 25.4 | 21 | 20.2 | 20 | 22.7 | 9 | 31.0 | 3 | 6.5 | 6 | 19.4 | 3 | 10.7 |
| Skilled<br>$5,000 to $7,500 | 23 | 13.0 | 27 | 26.0 | 12 | 13.6 | 7 | 24.1 | 20 | 43.5 | 13 | 41.9 | 13 | 46.4 |
| Semi-Skilled<br>$3,000 to $5,000 | 61 | 34.5 | 25 | 24.0 | 35 | 39.8 | 10 | 34.5 | 13 | 28.3 | 4 | 29.0 | 5 | 17.9 |
| Laborer<br>$1,000 to $3,000 | 8 | 4.5 | 5 | 4.8 | 5 | 5.7 | 1 | 3.4 | 4 | 8.7 | 0 | 9.7 | 0 | 0 |
| Unemployed<br>------- | 10 | 5.6 | 11 | 10.6 | 3 | 3.4 | 1 | 3.4 | 0 | 0 | 1 | 12.9 | 2 | 7.1 |
| Unknown<br>------- | 16 | 9.0 | 10 | 9.6 | 9 | 10.2 | 0 | 0 | 2 | 4.3 | 3 | 9.7 | 2 | 7.1 |

## Table 22

### Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Race and Sex)

| Diagnostic Categories of the $\overline{503}$ Group | Negro | | White | | Male | | Female | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Language Disorder | 18 | 10.2 | 159 | 89.8 | 136 | 76.8 | 41 | 23.2 |
| Mental Retardation | 17 | 16.3 | 87 | 83.7 | 71 | 68.3 | 33 | 31.7 |
| Emotional Disturbance | 13 | 14.8 | 75 | 85.2 | 59 | 67.0 | 29 | 33.0 |
| Immature Behavior | 3 | 9.7 | 28 | 90.3 | 25 | 80.6 | 6 | 19.4 |
| Hearing Loss | 2 | 6.9 | 27 | 93.1 | 14 | 48.3 | 15 | 51.7 |
| Articulation Disorder | 6 | 13.0 | 40 | 87.0 | 27 | 58.7 | 19 | 41.3 |
| Not Differentiated | 4 | 14.3 | 24 | 85.7 | 19 | 67.9 | 9 | 32.1 |
| Chi-Square Value and Significance Level | | 2.527: | | .30 .20 | | 15.430; | | .02 .01 |

Table 23

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Prenatal Problems)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Miscarriage | | Rh Incompatibility | | Nausea | | Hemorrhage | | Toxemia | | Emotional Tension | | Familial Problems | | Accidents | | Other Problems | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 37 | 20.9 | 21 | 11.9 | 25 | 14.1 | 25 | 14.1 | 3 | 1.7 | 13 | 7.3 | 1 | 0.6 | 7 | 4.0 | 3 | 1.7 |
| Mental Retardation | 2 | 24 | 23.1 | 5 | 4.8 | 8 | 7.7 | 13 | 12.5 | 1 | 1.0 | 6 | 5.8 | 4 | 3.8 | 4 | 3.8 | 7 | 6.7 |
| Emotional Disturbance | 3 | 15 | 17.0 | 7 | 8.0 | 13 | 14.8 | 12 | 13.6 | 5 | 5.7 | 12 | 13.6 | 0 | - | 6 | 6.8 | 3 | 3.4 |
| Immature Behavior | 4 | 9 | 29.0 | 3 | 9.7 | 4 | 12.9 | 3 | 9.7 | 0 | - | 2 | 6.5 | 0 | - | 0 | - | 1 | 3.2 |
| Hearing Loss | 5 | 2 | 6.9 | 4 | 13.8 | 3 | 10.3 | 4 | 13.8 | 2 | 6.9 | 2 | 6.9 | 2 | 6.9 | 2 | 6.9 | 4 | 13.8 |
| Articulation Disorder | 6 | 7 | 15.2 | 2 | 4.3 | 2 | 4.3 | 2 | 4.3 | 0 | - | 2 | 4.3 | 0 | - | 1 | 2.2 | 3 | 6.5 |
| Not Differentiated | 7 | 6 | 21.4 | 3 | 10.7 | 1 | 3.6 | 3 | 10.7 | 1 | 3.6 | 0 | - | 0 | - | 2 | 7.1 | 0 | - |
| Chi-Square Based on #'s:<br>Chi-Square Value and<br>Significance Level | | 1, 2, & 3<br>1.076<br>.70 .50 | | 1, 2, 3, & 5<br>3.109<br>.30 .20 | | 1, 2, & 3<br>3.042<br>.30 .20 | | 1, 2, & 3<br>0.145<br>.95 .90 | | $x^2$ not<br>calcu-<br>lated | | 1, 2, & 3<br>3.090<br>.30 .20 | | $x^2$ not<br>calcu-<br>lated | | $x^2$ not<br>calcu-<br>lated | | $x^2$ not<br>calcu-<br>lated | |
| Total N | | 100 | | 45 | | 56 | | 62 | | 12 | | 37 | | 7 | | 22 | | 21 | |

## Table 24

### Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Birth Problems: Presentation, Labor, and Delivery)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Presentation Problems | | | | | | Labor Problems | | | | | | Delivery Problems | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-Cephalic Presentation Breech & other | | Breech Presentation | | Other Presentation | | Precipitate Labor | | Prolonged Labor | | Induced Labor | | Instruments Used | | Caesarian Section | | Cord Prolapse | | Anaesthesia Used | | Other Delivery Problems | |
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorder | 1 | 18 | 10.0 | 9 | 5.1 | 9 | 5.1 | 16 | 9.0 | 17 | 9.6 | 12 | 6.8 | 31 | 17.5 | 9 | 5.1 | 4 | 2.3 | 104 | 58.8 | 50 | 28.2 |
| Mental Retardation | 2 | 9 | 8.7 | 6 | 5.8 | 3 | 2.9 | 10 | 9.6 | 9 | 8.7 | 9 | 8.7 | 2 | 1.9 | 3 | 2.9 | 0 | - | 73 | 70.2 | 22 | 21.2 |
| Emotional Disturbance | 3 | 7 | 8.0 | 1 | 1.1 | 6 | 6.8 | 11 | 12.5 | 4 | 4.5 | 6 | 6.8 | 15 | 17.0 | 6 | 6.8 | 1 | 1.1 | 54 | 61.4 | 19 | 21.6 |
| Immature Behavior | 4 | 2 | 6.5 | 0 | - | 2 | 6.5 | 1 | 3.2 | 2 | 6.5 | 5 | 16.1 | 4 | 12.9 | 2 | 6.5 | 1 | 3.2 | 18 | 58.1 | 4 | 12.9 |
| Hearing Loss | 5 | 5 | 17.2 | 1 | 3.4 | 4 | 13.8 | 1 | 3.4 | 1 | 3.4 | 4 | 13.8 | 1 | 3.4 | 4 | 13.8 | 0 | - | 17 | 58.6 | 7 | 24.1 |
| Articulation Disorder | 6 | 5 | 10.9 | 1 | 2.2 | 4 | 8.7 | 3 | 6.5 | 5 | 10.9 | 0 | - | 4 | 8.7 | 4 | 8.7 | 1 | 2.2 | 38 | 82.6 | 2 | 4.3 |
| Not Differentiated | 7 | 5 | 17.9 | 5 | 17.9 | 0 | - | 2 | 7.1 | 5 | 17.9 | 3 | 10.7 | 4 | 14.3 | 0 | - | 0 | - | 20 | 71.4 | 0 | - |
| Chi-Square based on #'s: | | $x^2$ not calculated | | $x^2$ not calculated | | $x^2$ not calculated | | $x^2$ not calculated | | $x^2$ not calculated | | $x^2$ not calculated | | 1, 2, & 3 | | $x^2$ not calculated | | $x^2$ not calculated | | All 7 | | All 7 | |
| Chi-Square Value and Significance Level | | | | | | | | | | | | | | 13.690<br><.01 | | | | | | 12.557<br>.10>.05 | | 15.567<br>.02>.01 | |
| Total N | | 51 | | 23 | | 28 | | 44 | | 43 | | 39 | | 61 | | 28 | | 7 | | 324 | | 104 | |

Table 25

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group (Birth Problems: Conditions Present at Birth)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Anoxia | | Kerni-terus | | Anoma-lies | | Convul-sions | | Cyanosis | | Pre-maturity | | Post-maturity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 47 | 26.6 | 14 | 7.9 | 9 | 5.1 | 9 | 5.1 | 17 | 9.6 | 10 | 5.6 | 4 | 2.3 |
| Mental Retardation | 2 | 5 | 4.8 | 4 | 3.8 | 18 | 17.3 | 8 | 7.7 | 3 | 2.9 | 13 | 12.5 | 4 | 3.8 |
| Emotional Disturbance | 3 | 8 | 9.1 | 4 | 4.5 | 6 | 6.8 | 0 | - | 6 | 6.8 | 3 | 3.4 | 2 | 2.3 |
| Immature Behavior | 4 | 2 | 6.5 | 0 | - | 2 | 6.5 | 0 | - | 3 | 9.7 | 1 | 3.2 | 4 | 12.9 |
| Hearing Loss | 5 | 0 | - | 2 | 6.9 | 2 | 6.9 | 0 | - | 0 | - | 3 | 10.3 | 0 | - |
| Articulation Disorders | 6 | 0 | - | 0 | - | 2 | 4.3 | 0 | - | 1 | 2.2 | 2 | 4.3 | 1 | 2.2 |
| Not Differentiated | 7 | 0 | - | 1 | 3.6 | 4 | 14.3 | 0 | - | 0 | - | 1 | 3.6 | 2 | 7.1 |
| Chi-square based on #'s: | | 1, 2, &3 | | 1, 2, &3 | | 1, 2 & 3 | | $X^2$ | | 1, 2 & 3 | | 1, 2 &3 | | $X^2$ | |
| Chi-square value and significance level | | 22.706<br>$<.01$ | | 1.699<br>$.50 > .30$ | | 10.412<br>$<.01$ | | not calculated | | 3.644<br>$.20 > .10$ | | 5.316<br>$.10 > .05$ | | not calculated | |
| Total N | | 62 | | 25 | | 43 | | 17 | | 30 | | 33 | | 17 | |

## Table 26

## Comparison of Three Combined Dichotomous Variables Among Three Diagnostic Categories of the Total 503 Group

## (Anoxia, Kernicterus and Cyanosis Combined)

| Diagnostic Categories of the Total 503 Group | Anoxia, Kernicterus and Cyanosis Combined | |
|---|---|---|
| | N | % |
| Language Disorder | 78 | 44.0 |
| Mental Retardation | 12 | 11.5 |
| Emotional Disturbance | 18 | 20.5 |
| Chi-Square Value and Significance Level | 24.276 | $<.01$ |
| Total N | 108 | 100.0 |

## Table 27

### Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Postnatal Problems)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Colic | | Eczema | | Asthma | | Orthopedic Problems | | Strabismus | | Febrile Episodes | | Meningitis | | Encephalitis | | Surgery | | Convulsions | | Other Problems | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 15 | 8.5 | 6 | 3.4 | 4 | 2.3 | 5 | 2.8 | 16 | 9.0 | 50 | 28.2 | 0 | --- | 3 | 1.7 | 38 | 21.5 | 25 | 14.1 | 16 | 9.0 |
| Mental Retardation | 2 | 7 | 6.7 | 1 | 1.0 | 7 | 1.0 | 7 | 6.7 | 11 | 10.6 | 25 | 24.0 | 1 | 1.0 | 2 | 1.9 | 23 | 22.1 | 14 | 13.5 | 6 | 5.8 |
| Emotional Disturbance | 3 | 8 | 9.1 | 9 | 10.2 | 2 | 2.3 | 3 | 3.4 | 3 | 3.4 | 27 | 30.7 | 1 | 1.1 | 0 | --- | 17 | 19.3 | 3 | 3.4 | 5 | 5.7 |
| Immature Behavior | 4 | 2 | 6.5 | 2 | 6.5 | 1 | 3.2 | 0 | --- | 1 | 3.2 | 7 | 22.6 | 0 | --- | 0 | --- | 5 | 16.1 | 2 | 6.5 | 1 | 3.2 |
| Hearing Loss | 5 | 1 | 3.4 | 0 | --- | 0 | --- | 0 | --- | 1 | 3.4 | 5 | 17.2 | 0 | --- | 0 | --- | 4 | 13.8 | 1 | 3.4 | 1 | 3.4 |
| Articulation Disorder | 6 | 0 | --- | 1 | 2.2 | 3 | 6.5 | 2 | 4.3 | 0 | --- | 6 | 13.0 | 0 | --- | 0 | --- | 8 | 17.4 | 5 | 10.9 | 5 | 10.9 |
| Not Differentiated | 7 | 1 | 3.6 | 0 | --- | 0 | --- | 0 | --- | 3 | 10.7 | 4 | 14.3 | 0 | --- | 0 | --- | 4 | 14.3 | 1 | 3.6 | 0 | --- |
| Chi-Square based on #'s:<br>Chi-Square Value and Significance Level | | 1,2 & 3<br>0.151<br>.95>.90 | | $x^2$ not calculated | | $x^2$ not calculated | | $x^2$ not calculated | | 1,2 & 3<br>2.541<br>.30>.20 | | All 7<br>5.978<br>.50>.30 | | $x^2$ not calculated | | $x^2$ not calculated | | All 7<br>1.140<br>.98>95 | | 1,2 & 3<br>6.480<br>.05>.02 | | $x^2$ not Calculated | |
| Total N | | 34 | | 19 | | 11 | | 17 | | 35 | | 124 | | 2 | | 5 | | 99 | | 51 | | 34 | |

## Table 28

## Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group (Medical Diagnoses)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Organicity | | Anomalies | | Endocrine Disorders | | Un-differentiated Problems | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 139 | 78.5 | 3 | 1.7 | 0 | - | 28 | 15.8 |
| Mental Retardation | 2 | 43 | 41.3 | 20 | 19.2 | 0 | - | 41 | 39.4 |
| Emotional Disturbance | 3 | 15 | 17.0 | 3 | 3.4 | 1 | 1.1 | 53 | 60.2 |
| Immature Behavior | 4 | 1 | 3.2 | 0 | - | 0 | - | 18 | 58.1 |
| Hearing Loss | 5 | 8 | 27.6 | 1 | 3.4 | 0 | - | 18 | 62.1 |
| Articulation Disorders | 6 | 2 | 4.3 | 0 | - | 0 | - | 25 | 54.3 |
| Not Differentiated | 7 | 4 | 14.3 | 4 | 14.3 | 0 | - | 17 | 60.7 |
| Chi-square based on #'s | | all 7 | | 1, 2, & 3 | | $X^2$ | | all 7 | |
| Chi-square value and significance level | | 102.119<br><.01 | | 28.588<br><.01 | | not calculated | | 77.325<br><.01 | |
| Total N | | 212 | | 31 | | 1 | | 200 | |

Table 29

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total 503 Group
(Behavior Problems Reported by Parents)

| Diagnostic Categories of the 503 Group | Numbers | Eneuresis (night) | | Eneuresis (day) | | Feeding Problems | | Sleeping Problems | | Destructiveness | | Temper Tantrums | | Negativism | | Sibling Rivalry | | Immaturity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Problems | 1 | 17 | 9.6 | 2 | 1.1 | 15 | 8.5 | 9 | 5.1 | 9 | 5.1 | 34 | 19.2 | 21 | 11.9 | 10 | 5.6 | 20 | 11.3 |
| Mental Retardation | 2 | 21 | 20.2 | 8 | 7.7 | 8 | 7.7 | 4 | 3.8 | 10 | 9.6 | 14 | 13.5 | 10 | 9.6 | 2 | 1.9 | 30 | 28.1 |
| Emotional Disturbance | 3 | 15 | 17.0 | 5 | 5.7 | 10 | 11.4 | 14 | 15.9 | 16 | 18.2 | 28 | 31.8 | 17 | 19.3 | 22 | 25.0 | 20 | 22.7 |
| Immature Behavior | 4 | 1 | 3.2 | 0 | - | 0 | - | 1 | 3.2 | 0 | - | 1 | 3.2 | 2 | 6.5 | 1 | 3.2 | 10 | 32.3 |
| Hearing Loss | 5 | 1 | 3.4 | 0 | - | 4 | 13.8 | 0 | - | 4 | 13.8 | 6 | 20.7 | 7 | 24.1 | 1 | 3.4 | 3 | 10.3 |
| Articulation Disorder | 6 | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 0 | - | 2 | 4.3 | 3 | 6.5 |
| Not Differentiated | 7 | 6 | 21.4 | 2 | 7.1 | 1 | 3.6 | 0 | - | 1 | 3.6 | 3 | 10.7 | 0 | - | 3 | 10.7 | 7 | 25.0 |
| Chi-square based on #'s<br>Chi-square value and significance level | | 1, 2 & 3<br>6.650<br>.05>.02 | | $X^2$<br>not<br>calculated | | 1, 2 & 3<br>0.450<br>.80 >.70 | | 1, 2, & 3<br>10.219<br><.01 | | 1, 2, & 3<br>9.744<br><.01 | | 1, 2, 3, 4,<br>5, & 6<br>21.563<br><.01 | | 1, 2, 3 & 6<br>9.296<br><.01 | | 1, 2, & 3<br>29.796<br><.01 | | all 7<br>18.244<br><.01 | |
| Total N | | 61 | | 17 | | 38 | | 28 | | 40 | | 86 | | 57 | | 41 | | 93 | |

## Table 30
## Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group
(Behavior Problems Reported by Parents)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Head Banging |  | Body Rocking |  | Behavior Changes Following Illness |  | Hyper-activity |  | Motor Problems (gross) |  | Motor Problems (fine) |  | Perseveration |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 10 | 5.6 | 12 | 6.8 | 6 | 3.4 | 51 | 28.8 | 64 | 36.2 | 70 | 39.5 | 0 | - |
| Mental Retardation | 2 | 9 | 8.7 | 17 | 16.3 | 4 | 3.8 | 38 | 36.5 | 33 | 31.7 | 26 | 25.0 | 2 | 1.9 |
| Emotional Disturbance | 3 | 10 | 11.4 | 14 | 15.9 | 2 | 2.3 | 32 | 36.4 | 9 | 10.2 | 6 | 6.8 | 1 | 1.1 |
| Immature Behavior | 4 | 2 | 6.5 | 1 | 3.2 | 0 | - | 0 | - | 2 | 6.5 | 2 | 6.5 | 0 | - |
| Hearing Loss | 5 | 0 | - | 3 | 10.3 | 2 | 6.9 | 9 | 31.0 | 1 | 3.4 | 4 | 13.8 | 0 | - |
| Articulation Disorders | 6 | 0 | - | 0 | - | 1 | 2.2 | 0 | - | 3 | 6.5 | 6 | 13.0 | 0 | - |
| Not Differentiated | 7 | 0 | - | 1 | 3.6 | 0 | - | 5 | 17.9 | 0 | - | 3 | 10.7 | 0 | - |
| Chi-square based on #'s |  | 1, 2 &3 |  | 1,2 &3 |  | $X^2$ |  | all 7 |  | all 7 |  | all 7 |  | $X^2$ |  |
| Chi-square value and significance level |  | 2,078<br>.50 >.30 |  | 7.858<br>.02 >.01 |  | not calculated |  | 27.179<br><.01 |  | 42.262<br><.01 |  | 37.834<br><.01 |  | not calculated |  |
| Total N |  | 31 |  | 48 |  | 15 |  | 135 |  | 112 |  | 117 |  | 3 |  |

Table 31

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Behavior Problems and Test Responses Reported by Examiners)

| Diagnostic Categories of the $\overline{503}$ Group | Number | Short Attention Span | | Hyperactivity | | Separation Problem | | Perseveration | | Lack of Contact | | Poor Emotional Tone | | Drooling | | Tremors | | Destructiveness | | Aggressiveness | | No Localization of Sound | | Asteriognosis | | Visual-Motor Problem | | Comprehension Problem | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorder | 1 | 59 | 33.3 | 41 | 23.2 | 14 | 7.9 | 19 | 10.7 | 15 | 8.5 | 12 | 6.8 | 23 | 13.0 | 84 | 47.5 | 4 | 2.3 | 2 | 1.1 | 118 | 66.7 | 86 | 48.6 | 110 | 62.1 | 148 | 83.6 |
| Mental Retardation | 2 | 61 | 58.7 | 36 | 34.6 | 13 | 12.5 | 8 | 7.7 | 19 | 18.3 | 13 | 12.5 | 11 | 10.6 | 47 | 45.2 | 5 | 4.8 | 8 | 7.7 | 9 | 8.7 | 22 | 21.2 | 43 | 41.3 | 82 | 78.8 |
| Emotional Disturbance | 3 | 20 | 22.7 | 21 | 23.9 | 15 | 17.0 | 2 | 2.3 | 12 | 13.6 | 22 | 25.0 | 7 | 8.0 | 19 | 21.6 | 3 | 3.4 | 5 | 5.7 | 5 | 5.7 | 0 | ---- | 8 | 9.1 | 36 | 40.9 |
| Immature Behavior | 4 | 4 | 12.9 | 0 | ---- | 3 | 9.7 | 0 | ---- | 0 | ---- | 0 | ---- | 2 | 6.5 | 6 | 19.4 | 0 | --- | 1 | 3.2 | 0 | ---- | 6 | 19.4 | 1 | 3.2 | 3 | 9.7 |
| Hearing Loss | 5 | 5 | 17.2 | 7 | 24.1 | 6 | 20.7 | 1 | 3.4 | 0 | ---- | 1 | 3.4 | 1 | 3.4 | 4 | 13.8 | 1 | 3.4 | 0 | --- | 5 | 17.2 | 0 | ---- | 5 | 17.2 | 19 | 65.6 |
| Articulation Disorder | 6 | 2 | 4.3 | 0 | ---- | 0 | ---- | 0 | ---- | 0 | ---- | 2 | 4.3 | 2 | 4.3 | 4 | 8.7 | 0 | --- | 0 | --- | 2 | 4.3 | 5 | 10.9 | 5 | 10.9 | 2 | 4.3 |
| Not Differentiated | 7 | 10 | 35.7 | 4 | 14.3 | 5 | 17.9 | 3 | 10.7 | 1 | 3.6 | 2 | 7.1 | 4 | 14.3 | 9 | 32.1 | 0 | --- | 0 | --- | 1 | 3.6 | 2 | 7.1 | 7 | 25.0 | 13 | 46.4 |
| Chi-Square based on #'s: | | All 7 | | 1,2,3,5&7 | | 1,2 &3 | | 1,2 &3 | | 1,2 &3 | | 1,2 &3 | | 1,2 &3 | | All 7 | | $x^2$ not calculated | | $x^2$ not calculated | | 1,2 &3 | | All 7 | | All 7 | | All 7 | |
| Chi-Square Value and Significance Level | | 41.067<br><.01 | | 4.812<br>.20>.10 | | 5.046<br>.10>.05 | | 4.682<br>.10>.05 | | 5.902<br>.10>.05 | | 17.580<br><.01 | | 1.123<br>.70>.50 | | 30.739<br><.01 | | | | | | 90.880<br><.01 | | 77.937<br><.01 | | 73.788<br><.01 | | 65.525<br><.01 | |
| Total N | | 161 | | 109 | | 56 | | 33 | | 47 | | 52 | | 50 | | 173 | | 13 | | 16 | | 140 | | 121 | | 179 | | 303 | |

Table 32

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group
(Objective Test Items)

| Diagnostic Categories of the $\overline{503}$ group | Numbers | From board Failed | | Geometric Designs Failed | | Pictures Identified in the Following Manner: | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Pointing | | Gesturing | | Naming | | Unable to identify pictures | |
| | | | | | | Chi-square on total table, exclusive of "gesturing" = 108.484; P = <.01 | | | | | | | |
| | | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 127 | 71.8 | 139 | 78.5 | 26 | 14.69 | 2 | 1.13 | 68 | 38.42 | 81 | 45.76 |
| Mental Retardation | 2 | 96 | 92.3 | 100 | 96.2 | 16 | 15.38 | 2 | 1.92 | 19 | 18.27 | 67 | 64.42 |
| Emotional Disturbance | 3 | 60 | 68.2 | 68 | 77.3 | 11 | 12.50 | 2 | 2.27 | 27 | 30.68 | 48 | 54.55 |
| Immature Behavior | 4 | 16 | 51.6 | 4 | 12.9 | 6 | 19.35 | 0 | - | 14 | 45.16 | 11 | 35.48 |
| Hearing Loss | 5 | 19 | 65.5 | 14 | 48.3 | 4 | 13.79 | 2 | 6.90 | 2 | 6.90 | 21 | 72.41 |
| Articulation Disorders | 6 | 10 | 21.7 | 36 | 78.3 | 0 | - | 0 | - | 46 | 100.00 | 0 | - |
| Not Differentiated | 7 | 26 | 92.9 | 21 | 75.0 | 5 | 17.85 | 0 | - | 7 | 25.00 | 16 | 57.14 |
| Chi-square based on #'s | | all 7 | | all 7 | | all 7 | | $X^2$ not computed | | all 7 | | all 7 | |
| Chi-square value and significance level | | 88.908<br><.01 | | 24.951<br><.01 | | 6.330<br>.70 >.50 | | | | 66.862<br><.01 | | 35.292<br><.01 | |
| Total N | | 354 | | 382 | | 68 | | 8 | | 183 | | 244 | |

## Table 33

## Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group (Speech Development Level)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | No Speech | | Delayed Speech | | Level of Speech Delay (Only delayed speech included) | | | | | | Jargon | | Echolalia | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | words | | phrases | | sentences | | | | | |
| | | | | | | Levels are mutually exclusive | | | | | | | | | |
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 26 | 14.7 | 74 | 41.8 | 26 | 35.1 | 40 | 54.1 | 8 | 10.8 | 15 | 8.5 | 9 | 5.1 |
| Mental Retardation | 2 | 28 | 26.9 | 48 | 46.2 | 17 | 35.4 | 19 | 39.6 | 12 | 25.0 | 12 | 11.5 | 6 | 5.8 |
| Emotional Disturbance | 3 | 14 | 15.9 | 36 | 40.9 | 16 | 44.4 | 17 | 47.2 | 3 | 8.3 | 2 | 2.3 | 5 | 5.7 |
| Immature Behavior | 4 | 1 | 3.2 | 30 | 96.8 | 6 | 20.0 | 9 | 30.0 | 15 | 50.0 | 0 | - | 0 | - |
| Hearing Loss | 5 | 14 | 48.3 | 12 | 41.4 | 5 | 41.7 | 7 | 58.3 | 0 | - | 2 | 6.9 | 1 | 3.4 |
| Articulation Disorders | 6 | 0 | - | 0 | - | 0 | - | 0 | 0 | 0 | - | 0 | - | 0 | - |
| Not Differentiated | 7 | 4 | 14.3 | 16 | 57.1 | 8 | 50.0 | 5 | 31.3 | 3 | 18.8 | 2 | 7.1 | 2 | 7.1 |
| Chi-square based on #'s | | 1, 2, 3, 4, 5, & 6 | | all 7 | | 1, 2, 3, 4, & 7 | | 1, 2, 3, 4, 5 & 7 | | 1, 2, 3, 4 | | 1, 2 &3 | | $X^2$ not calcu-lated | |
| Chi-square value and significance level | | 30.158<br><.01 | | 42.392<br><.01 | | 3.405<br>.70 > .50 | | 3.833<br>.70 > .50 | | 16.807<br><.01 | | 4,259<br>.20 >.10 | | | |
| Total N | | 87 | | 216 | | 78 | | 97 | | 41 | | 33 | | 23 | |

## Table 34

Comparison of the Single Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group
(Speech: Articulation Problems)

| Diagnostic Categories of the $\overline{503}$ Group | Numbers | Articulation Disorders | | Type of Articulation Disorder (Types not Mutually Exclusive) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Omissions | | Substitutions | | Distortions | |
| | | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 49 | 27.7 | 13 | 26.5 | 39 | 79.6 | 11 | 22.4 |
| Mental Retardation | 2 | 10 | 9.6 | 5 | 50.0 | 7 | 70.0 | 2 | 20.0 |
| Emotional Disturbance | 3 | 31 | 35.2 | 7 | 22.6 | 26 | 83.9 | 7 | 22.6 |
| Immature Behavior | 4 | 0 | - | 0 | - | 0 | - | 0 | - |
| Hearing Loss | 5 | 0 | - | 0 | - | 0 | - | 0 | - |
| Articulation Disorders | 6 | 46 | 100.0 | 13 | 28.3 | 37 | 80.4 | 17 | 37.0 |
| Not Differentiated | 7 | 4 | 14.3 | 1 | 25.0 | 3 | 75.0 | 2 | 50.0 |
| Chi-square based on #'s | | 1, 2, 3, 4, 5 & 7 | | 1, 3, & 6 | | 1, 2, 3 & 6 | | 1, 2 & 6 | |
| Chi-square value and significance level | | 30.312<br><.01 | | 0.124<br>.98 > .95 | | 0.089<br>.98 > .95 | | 2.039<br>.50 > .30 | |
| Total N | | 94 | | 39 | | 112 | | 39 | |

## Table 35

### Comparison of the Combined Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

("Total" Group)

| Diagnostic Categories of the $\overline{503}$ Group | | Prenatal History Items | | Birth Presentation History Items | | Neonatal History Items | | Delivery History Items | | Postnatal History* Items | | Possible Organic History Items * | | High Temperature Disease History Items * | | Surgery History Items* | | Medical Diagnoses | | Possible Psychoneurotic Behavior Problems * | | Possible Psychomotor Behavior Problems* | | Possible Organic Behavior Problems* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 95 | 53.7 | 18 | 10.2 | 29 | 16.4 | 168 | 94.9 | 24 | 13.6 | 44 | 24.9 | 51 | 28.8 | 38 | 21.5 | 169 | 95.5 | 85 | 48.0 | 18 | 10.2 | 126 | 71.2 |
| Mental Retardation | 2 | 50 | 48.1 | 9 | 8.7 | 29 | 27.9 | 96 | 92.3 | 9 | 8.7 | 27 | 26.0 | 26 | 25.0 | 23 | 22.1 | 101 | 97.1 | 61 | 58.7 | 19 | 18.3 | 69 | 66.4 |
| Emotional Disturbance | 3 | 47 | 53.4 | 7 | 8.0 | 9 | 10.2 | 81 | 92.1 | 16 | 18.2 | 7 | 8.0 | 28 | 38.1 | 17 | 19.3 | 72 | 81.8 | 67 | 76.1 | 17 | 19.3 | 41 | 46.6 |
| Immature Behavior | 4 | 15 | 48.4 | 2 | 6.5 | 2 | 6.5 | 25 | 80.7 | 4 | 12.9 | 3 | 9.7 | 7 | 22.6 | 5 | 16.1 | 19 | 61.3 | 13 | 41.9 | 2 | 6.5 | 3 | 9.7 |
| Hearing Loss | 5 | 17 | 58.6 | 5 | 17.2 | 4 | 13.8 | 25 | 86.2 | 1 | 3.5 | 2 | 6.9 | 5 | 17.2 | 4 | 13.8 | 26 | 89.7 | 15 | 51.7 | 3 | 10.3 | 13 | 44.8 |
| Articulation Disorder | 6 | 17 | 37.0 | 5 | 10.9 | 2 | 4.4 | 43 | 93.5 | 3 | 6.5 | 7 | 15.2 | 6 | 13.0 | 8 | 17.4 | 27 | 58.7 | 5 | 10.9 | 0 | -- | 8 | 17.4 |
| Not Differentiated | 7 | 13 | 46.4 | 5 | 17.9 | 5 | 17.9 | 24 | 85.7 | 1 | 3.6 | 4 | 14.3 | 4 | 14.3 | 4 | 14.3 | 24 | 85.7 | 13 | 46.4 | 1 | 3.6 | 6 | 21.4 |
| Chi-Square based on #'s: | | All 7 | | 1, 2, & 3 | | 1,2,3 &6 | | All 7 | | 1,2,3 &6 | | All 7 | | All 7 | | All 7 | | All 7 | | All 7 | | 1,2,3 &6 | | All 7 | |
| Chi-Square Value & Significance | | 5.640 | | 0.222 | | 10.100 | | 10.258 | | 4.529 | | 14.699 | | 6.513 | | 1.140 | | 74.046 | | 116.120 | | 11.025 | | 91.107 | |
| Level | | .50 .30 | | .90 .80 | | .02 .01 | | .20 .10 | | .30 .20 | | .05 .01 | | .40 .30 | | .99 .98 | | .01 | | .01 | | .02 .01 | | .01 | |
| Total N | | 254 | | 51 | | 80 | | 462 | | 58 | | 94 | | 127 | | 99 | | 438 | | 259 | | 60 | | 266 | |

## Table 36

## Composition of the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Primary and Secondary Diagnoses)*

| Secondary Diagnosis | Primary Diagnosis: Language Disorder N | Language Disorder % | Mental Retardation N | Mental Retardation % | Emotional Disturbance N | Emotional Disturbance % | Hearing Loss N | Hearing Loss % |
|---|---|---|---|---|---|---|---|---|
| Pure | 67 | 37.85 | 74 | 71.15 | 80 | 90.91 | 15 | 51.72 |
| Mental Retardation | 33 | 18.64 | -- | -- | 7 | 7.95 | 2 | 6.90 |
| Emotional Disturbance | 46 | 25.99 | 23 | 22.12 | -- | -- | 11 | 37.93 |
| Hearing Loss | 12 | 6.78 | 5 | 4.81 | X | X | -- | -- |
| Mental Retardation & Emotional Disturbance | 8 | 4.52 | X | X | X | X | 1 | 3.45 |
| Mental Retardation & Hearing Loss | 5 | 2.82 | X | X | 1 | 1.14 | X | X |
| Emotional Disturbance & Hearing Loss | 5 | 2.82 | 2 | 1.92 | X | X | X | X |
| Mental Retardation & Emotional Disturbance & Hearing Loss | 1 | 0.56 | X | X | X | X | X | X |
| Total "Mixed" | 110 | 62.15 | 30 | 28.85 | 8 | 9.09 | 14 | 48.28 |
| Total "Mixed" without Mental Retardation | 63 | 35.59 | -- | -- | X | X | 11 | 37.93 |
| Total | 177 | | 104 | | 88 | | 29 | |

X indicates the combination was not found.

* The A/D, I/B and N/D groups were "pure" groups by definition and are not included in this table.

## Table 37

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age Walked in Months)

| Diagnostic Categories of the $\overline{503}$ Group "Pure" sub-group only | N | Mean | S.D. | Difference, t-ratio, and Significance Level<br>L/D | <br>M/R | <br>E/D | <br>H/L | <br>A/D | <br>I/B | <br>N/D |
|---|---|---|---|---|---|---|---|---|---|---|
| Language Disorder | 66 | 13.212 | 2.842 | -- | 4.325<br>6.196<br>P=<.001 | 0.238<br>0.354<br>.80>.70 | 0.998<br>0.843<br>.50>.40 | 0.417<br>0.533<br>.60>.50 | 1.045<br>1.179<br>.30>.20 | 1.096<br>1.176<br>.30>.20 |
| Mental Retardation | 67 | 17.537 | 6.085 |  | -- | 4.563<br>6.810<br><.001 | 5.323<br>4.500<br><.001 | 4.742<br>6.072<br><.001 | 5.370<br>6.075<br><.001 | 3.229<br>3.472<br><.001 |
| Emotional Disturbance | 78 | 12.974 | 3.721 |  |  | -- | 0.760<br>0.651<br>.60>.50 | -- | 0.807<br>0.933<br>.40>.30 | 1.334<br>1.464<br>.20>.10 |
| Hearing Loss | 14 | 12.214 | 2.210 |  |  |  | -- | 0.581<br>0.470<br>.70>.60 | -- | 2.094<br>1.570<br>.20>.10 |
| Articulation Disorder | 44 | 12.795 | 2.896 |  |  |  |  | -- | 0.628<br>0.659<br>.60>.50 | 1.513<br>1.519<br>.20>.10 |
| Immature Behavior | 30 | 12.167 | 2.570 |  |  |  |  |  | -- | 2.141<br>1.986<br>.05>.02 |
| Not Differentiated | 26 | 14.308 | 4.027 |  |  |  |  |  |  | -- |
| F-Ratio & Significance Level |  | 12.058<br><.01 |  |  |  |  |  |  |  |  |

*In each cell, the top number is the difference; the middle number, the t-ratio; and the bottom number, the significance level.

## Table 38

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Age Words in Months)

| Diagnostic Categories of the $\overline{503}$ Group "Pure" sub-group only | N | Mean | S.D. | Difference, t-ratio, and Significance Level | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
| Language Disorder | 62 | 28.484 | 11.501 | -- | 4.947<br>2.386<br>.02>.01 | 2.969<br>1.542<br>.20>.10 | 2.084<br>0.409<br>.70>.60 | 7.391<br>3.397<br><.001 | 3.346<br>1.356<br>.20>.10 | 1.380<br>0.507<br>.70>.60 |
| Mental Retardation | 51 | 33.431 | 14.853 | | -- | 7.916<br>3.898<br><.001 | 7.031<br>1.368<br>.20>.10 | 12.338<br>5.435<br><.001 | 8.293<br>3.252<br>.01>.001 | 3.567<br>1.275<br>.30>.20 |
| Emotional Disturbance | 68 | 25.515 | 9.300 | | | -- | -- | 4.422<br>2.070<br>.05>.02 | 0.377<br>0.155<br>.90>.80 | 4.349<br>1.617<br>.20>.10 |
| Hearing Loss | 5 | 26.400 | 8.980 | | | | -- | 5.307<br>1.024<br>.40>.30 | 1.262<br>0.238<br>.90>.80 | 3.464<br>0.638<br>.60>.50 |
| Articulation Disorder | 43 | 21.093 | 8.291 | | | | | -- | 4.045<br>1.535<br>.20>.10 | 8.771<br>3.052<br>.01>.001 |
| Immature Behavior | 29 | 25.138 | 7.523 | | | | | | -- | 4.726<br>1.525<br>.20>.10 |
| Not Differentiated | 22 | 29.864 | 10.636 | | | | | | | -- |
| F-Ratio and Significance Level | | 5.768<br><.01 | | | | | | | | |

## Table 39

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age Sentences in Months)

| Diagnostic Categories of the $\overline{503}$ Group "Pure" sub-group only | N | Mean | S. D. | Difference, t-ratio, and Significance Level | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
| Language Disorder | 50 | 38.180 | 10.501 | -- | 5.562<br>2.169<br>.05>.02 | 2.992<br>1.320<br>.20>.10 | -- | 6.305<br>2.650<br>.01>.001 | 4.876<br>1.725<br>.10>.05 | 0.180<br>0.055<br>>.90 |
| Mental Retardation | 31 | 43.742 | 14.514 | | -- | 8.554<br>3.310<br><.001 | -- | 11.867<br>4.421<br><.001 | 10.438<br>3.382<br><.001 | 5.742<br>1.628<br>.20>.10 |
| Emotional Disturbance | 48 | 35.188 | 9.528 | | | -- | -- | 3.313<br>1.380<br>.20>.10 | 1.884<br>0.662<br>.60>.50 | 2.812<br>0.847<br>.40>.30 |
| Hearing Loss | 4 | 41.250 | 4.437 | | | | -- | -- | -- | -- |
| Articulation Disorder | 40 | 31.875 | 10.088 | | | | | -- | 1.429<br>0.487<br>.70>.60 | 6.125<br>1.804<br>.10>.05 |
| Immature Behavior | 23 | 33.304 | 11.196 | | | | | | | 4.696<br>1.262<br>.30>.20 |
| Not Differentiated | 15 | 38.000 | 11.337 | | | | | | | -- |
| F-Ratio and Significance Level | | 4.728<br><01 | | | | | | | | |

## Table 40

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Tested I. Q.)

| Diagnostic Categories of the $\overline{503}$ Group "Pure" sub-group only | N | Mean | S.D. | Difference, t-ratio, and Significance Level<br>L/D | M/R | E/D | H/L | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|---|---|---|
| Language Disorder | 67 | 90.328 | 14.689 | -- | -- | 8.496<br>3.496<br>P=<.001 | 11.572<br>2.625<br>.01>.001 | 11.183<br>4.462<br><.001 | 5.188<br>1.837<br>.10>.05 | 10.861<br>6.126<br><.001 |
| Mental Retardation | 71 | 64.225 | 13.256 | | -- | -- | -- | -- | -- | -- |
| Emotional Disturbance | 51 | 98.824 | 13.715 | | | -- | 3.076<br>0.653<br>.60>.50 | 2.687<br>1.011<br>.40>.30 | 3.308<br>1.117<br>.30>.20 | 19.357<br>5.069<br><.001 |
| Hearing Loss | 10 | 101.900 | 17.484 | | | | -- | -- | 6.384<br>1.350<br>.20>.10 | 22.433<br>4.226<br><.001 |
| Articulation Disorder | 45 | 101.511 | 10.156 | | | | | -- | 5.995<br>1.975<br>.05>.02 | 22.044<br>5.686<br><.001 |
| Immature Behavior | 31 | 95.516 | 8.032 | | | | | | -- | 16.049<br>3.924<br><.001 |
| Not Differentiated | 15 | 79.467 | 12.285 | | | | | | | -- |
| F-ratio and Significance Level | | 10.212<br><.01 | | | | | | | | |

## Table 41

## Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### (Estimated Potential I. Q.)

| Diagnostic Categories of the $\overline{503}$ Group "Pure" sub-group only | N | Mean | S. D. | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Difference, t-ratio, and Significance Level * | | | | | | |
| Language Disorder | 67 | 101.403 | 11.076 | -- | -- | 1.832<br>0.829<br>.50>.40 | 9.415<br>2.433<br>.02>.01 | 0.930<br>0.406<br>.70>.60 | 2.274<br>0.880<br>.40>.30 | 11.936<br>3.513<br><.001 |
| Mental Retardation | 71 | 68.099 | 13.147 | -- | -- | -- | -- | -- | -- | -- |
| Emotional Disturbance | 51 | 103.235 | 14.205 | | | -- | 7.583<br>1.918<br>.10>.05 | 0.902<br>0.371<br>.80>.70 | 4.106<br>1.516<br>.20>.10 | 13.768<br>3.940<br><.001 |
| Hearing Loss | 11 | 110.818 | 16.375 | | | | -- | 8.485<br>2.121<br>.05>.02 | 11.689<br>2.800<br>.01>.001 | 21.351<br>4.522<br><.001 |
| Articulation Disorder | 45 | 102.333 | 9.350 | | | | | -- | 3.204<br>1.154<br>.30>.20 | 12.866<br>3.628<br><.001 |
| Immature Behavior | 31 | 99.129 | 11.653 | | | | | | | 9.662<br>2.583<br>.01<.001 |
| Not Differentiated | 15 | 89.467 | 6.692 | | | | | | | |
| F-ratio and Significance Level | | 4.922<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

## Table 42

## Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age walk in months)

| Diagnostic Categories of the $\overline{503}$ Group<br>Total "Mixed" sub-groups only | N | MEAN | S. D. | Difference, t-ratio, and Significance Level* L/D. | M/R | E/D | H/L | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|---|---|---|
| Language Disorder | 106 | 14.783 | 4.560 | — | 1.288<br>1.395<br>.20 > .10 | -- | -- | 1.988<br>2.552<br>.02 > .01 | 2.616<br>2.913<br>.01 > .001 | 0.475<br>0.499<br>.70 > .60 |
| Mental Retardation | 28 | 16.071 | 5.257 | | -- | 1.321<br>0.758<br>.50 > .40 | 0.840<br>0.576<br>.60 > .50 | 3.276<br>3.120<br>.01 > .001 | 3.904<br>3.419<br><.001 | 1.763<br>1.490<br>.20 > .10 |
| Emotional Disturbance | 8 | 14.750 | 4.994 | | | -- | -- | 1.955<br>1.171<br>.30 > .20 | 2.583<br>1.494<br>.20 > .10 | 0.442<br>0.252<br>.90 > .80 |
| Hearing Loss | 13 | 15.231 | 6.290 | | | | -- | 2.436<br>1.777<br>.10 > .05 | 3.064<br>2.123<br>.05 > .02 | 0.923<br>0.625<br>.60 > .50 |
| Articulation Disorder | 44 | 12.795 | 2.896 | | | | | -- | X | X |
| Immature Behavior | 30 | 12.167 | 2.570 | | | | | | X<br>-- | X |
| Not Differentiated | 26 | 14.308 | 4.027 | | | | | | | -- |
| F-ratio and Significance Level | | 3.187<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

## Table 43

### Comparisons Among the Seven Diagnostic Categories of the Total 503 Group

(Age words in months)

| Diagnostic Categories of the 503 Group<br>Total "Mixed" Sub-group only | N | Mean | S. D. | Difference, t-ratio, and Significance Level* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
| Language Disorder | 75 | 27.613 | 11.816 | -- | 1.176<br>0.413<br>.70>.60 | -- | 7.187<br>1.925<br>.10>.05 | 6.520<br>3.074<br>.01>.001 | 2.475<br>1.021<br>.40>.30 | 2.251<br>0.837<br>.50>.40 |
| Mental Retardation | 19 | 28.789 | 12.813 | | -- | -- | 6.011<br>1.387<br>.20>.10 | 7.696<br>2.519<br>.02>.01 | 3.651<br>1.115<br>.40>.30 | 1.075<br>0.310<br>.80>.70 |
| Emotional Disturbance | 4 | 26.000 | | | | -- | -- | -- | -- | -- |
| Hearing Loss | 10 | 34.800 | 17.139 | | | | | 13.707<br>3.520<br><.001 | 9.662<br>2.376<br>.02>.01 | 4.936<br>1.167<br>.30>.20 |
| Articulation Disorder | 43 | 21.093 | 8.291 | | | | | -- | X | X |
| Immature Behavior | 29 | 25.138 | 7.523 | | | | | | X | X |
| Not Differentiated | 22 | 29.864 | 10.636 | | | | | | | |
| F-ratio and Significance Level | | 3.969<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

Table 44

Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age sentences in months)

| Diagnostic Categories of the $\overline{503}$ Group Total "Mixed" Sub-group only | N | Mean | S.D. | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Difference, t-ratio, and Significance Level* | | | | | | |
| Language Disorder | 49 | 39.796 | 11.822 | -- | 8.079<br>1.874<br>.10>.05 | | 11.804<br>2.225<br>.05>.02 | 7.921<br>3.289<br>.01>.001 | 6.492<br>2.272<br>.05>.02 | 1.796<br>0.539<br>.60>.50 |
| Mental Retardation | 8 | 47.875 | 8.838 | | -- | -- | 3.725<br>0.578<br>.60>.50 | 16.000<br>3.655<br><.001 | 14.571<br>3.141<br>.01>.001 | 9.875<br>1.996<br>.05>.02 |
| Emotional Disturbance | 2 | 34.000 | | | | -- | -- | -- | -- | -- |
| Hearing Loss | 5 | 51.600 | 16.693 | | | | -- | 19.725<br>3.679<br><.001 | 18.296<br>3.281<br>.01>.001 | 13.600<br>2.330<br>.02>.01 |
| Articulation Disorder | 40 | 31.875 | 10.088 | | | | | -- | X | X |
| Immature Behavior | 23 | 33.304 | 11.196 | | | | | | X<br>-- | X |
| Not Differentiated | 15 | 38.000 | 11.337 | | | | | | | -- |
| F-ratio and Significance Level | | 5.905<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

## Table 45

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Estimated potential I. Q.)

| Diagnostic Categories of the $\overline{503}$ Group | | | | Difference, t-ratio, and Significance Level* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total "Mixed" Sub-group only | N | Mean | S.D. | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
| Language Disorder | 110 | 96.191 | 10.631 | -- | -- | 6.477<br>1.542<br>.20>.10 | 2.809<br>0.824<br>.50>.40 | 6.142<br>3.221<br>.01>.001 | 2.938<br>1.341<br>.20>.10 | 6.724<br>2.267<br>.05>.02 |
| Mental Retardation | 25 | 67.960 | 14.127 | | -- | -- | -- | -- | -- | -- |
| Emotional Disturbance | 7 | 89.714 | 4.682 | | | -- | 9.286<br>1.782<br>.10>.05 | 12.619<br>2.882<br>.01>.001 | 9.415<br>2.088<br>.05>.02 | 0.247<br>0.050<br>>.90 |
| Hearing Loss | 11 | 99.000 | 17.425 | | | | -- | 3.333<br>0.919<br>.40>.30 | 0.129<br>0.034<br>>.90 | 9.533<br>2.228<br>.05>.02 |
| Articulation Disorder | 45 | 102.333 | 9.350 | | | | | -- | X | X |
| Immature Behavior | 31 | 99.129 | 11.653 | | | | | | -- | X<br>-- |
| Not Differentiated | 15 | 89.467 | 6.692 | | | | | | | -- |
| F-ratio and Significance Level | | 4.707<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

## Table 46

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Tested I. Q.)

| Diagnostic Categories of the $\overline{503}$ Group Total "Mixed" Sub-group only | N | Mean | S. D. | Difference, t-ratio, and Significance Level* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L/D | M/R | E/D | H/L | A/D | I/B | N/D |
| Language Disorder | 110 | 80.664 | 15.547 | -- | -- | 12.378<br>2.302<br>.05>.02 | 7.881<br>1.806<br>.10>.05 | 20.847<br>8.540<br><.001 | 14.852<br>5.295<br><.001 | 1.197<br>0.315<br>.80>.70 |
| Mental Retardation | 25 | 64.600 | 13.550 | | -- | -- | -- | -- | -- | -- |
| Emotional Disturbance | 7 | 68.286 | 11.068 | | | | 20.259<br>3.021<br>.01>.001 | 33.225<br>5.927<br><.001 | 27.230<br>4.717<br><.001 | 11.181<br>1.771<br>.10>.05 |
| Hearing Loss | 11 | 88.545 | 19.528 | | | | -- | 12.966<br>2.794<br>.01>.001 | 6.971<br>1.440<br>.20>.10 | 9.078<br>1.657<br>.10>.05 |
| Articulation Disorder | 45 | 101.511 | 10.156 | | | | | -- | X | X |
| Immature Behavior | 31 | 95.516 | 8.032 | | | | | | -- | X |
| Not Differentiated | 15 | 79.467 | 12.285 | | | | | | | -- |
| F-ratio and Significance Level | | 20.457<br><.01 | | | | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; and the bottom, the significance level.

## Table 47

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age walk in months)

| Diagnostic Categories of the $\overline{503}$ Group "Total mixed without Mental Retardation" only | N | Mean | S. D. | Difference, t-ratio, and Significance Level* | | | |
|---|---|---|---|---|---|---|---|
| | | | | H/L without M/R | A/D | I/B | N/D |
| Language Disorder | 60 | 13.733 | 3.229 | 1.067<br>0.907<br>.40>.30 | -- | -- | -- |
| Hearing Loss | 10 | 14.800 | 5.879 | -- | -- | -- | -- |
| Articulation Disorder | 44 | 12.795 | 2.896 | | -- | X | X |
| Immature Behavior | 30 | 12.167 | 2.570 | | | -- | X |
| Not Differentiated | 26 | 14.308 | 4.027 | | | | -- |
| F-ratio and Significance Level | | 2.298<br>>.05 | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; the bottom, the significance level.

## Table 48

### Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age words in months)

| Diagnostic Categories of the 503 Group "Total mixed without Mental Retardation" only | N | Mean | S. D. | Difference, t-ratio, and Significance Level*<br>H/L without M/R | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|
| Language Disorder | 40 | 26.726 | 12.896 | 10.024<br>2.390<br>.02>.01 | 5.633<br>2.367<br>.02>.01 | 1.588<br>0.601<br>.60>.50 | 3.138<br>1.091<br>.30>.20 |
| Hearing Loss | 8 | 36.750 | 17.086 | -- | 15.657<br>3,754<br><.001 | 11.612<br>2.684<br>.01>.001 | 6.886<br>1.540<br>.20>.10 |
| Articulation Disorder | 43 | 21.093 | 8.291 | | -- | X | X |
| Immature Behavior | 29 | 25.138 | 7.523 | | | -- | X |
| Not Differentiated | 22 | 29.864 | 10.636 | | | | -- |
| F-ratio and Significance Level | | 4.947<br><.01 | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; the bottom, the significance level.

Table 49

Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Age sentences in months)

| Diagnostic Categories of the 503 Group "Total mixed without Mental Retardation" only | N | Mean | S. D. | Difference, t-ratio, and Significance Level* | | | |
|---|---|---|---|---|---|---|---|
| | | | | H/L without M/R | A/D | I/B | N/D |
| Language Disorder | 29 | 37.862 | 12.678 | -- | 5.987<br>2.141<br>.05 > .02 | 4.558<br>1.423<br>.20 > .10 | 0.138<br>0.038<br>>.90 |
| Hearing Loss | 4 | 54.000 | 12.728 | -- | -- | -- | -- |
| Articulation Disorder | 40 | 31.875 | 10.088 | | -- | X | X |
| Immature Behavior | 23 | 33.304 | 11.196 | | | -- | X |
| Not Differentiated | 15 | 38.000 | 11.337 | | | | -- |
| F-ratio and Significance Level | | 3.301<br><.05 | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; the bottom, the significance level.

Table 50

Comparisons Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

(Tested I. Q.)

| Diagnostic Categories of the 503 Group "Total mixed without Mental Retardation" only | N | Mean | S. D. | Difference, t-ratio, and Significance Level* | | | |
|---|---|---|---|---|---|---|---|
| | | | | H/L without M/R | A/D | I/B | N/D |
| Language Disorder | 63 | 88.159 | 15.263 | 4.841<br>0.980<br>.40>.30 | 13.352<br>5.200<br><.001 | 7.357<br>2.549<br>.02>.01 | 13.352<br>5.200<br><.001 |
| Hearing Loss | 8 | 93.000 | 21.196 | -- | 8.511<br>1.686<br>.10>.05 | 2.516<br>0.482<br>.70>.60 | 13.533<br>2.349<br>.02>.01 |
| Articulation Disorder | 45 | 101.511 | 10.156 | | -- | X | X |
| Immature Behavior | 31 | 95.516 | 8.032 | | | -- | X |
| Not Differentiated | 15 | 79.467 | 12.285 | | | | -- |
| F-ratio and Significance Level | | 11.073<br><.01 | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; the bottom, the significance level.

Table 51

## Comparisons Among the Seven Diagnostic Categories of the Total 503 Group

(Estimated Potential I. Q.)

| Diagnostic Categories of the 503 Group "Total mixed without Mental Retardation" only | N | Mean | S. D. | H/L without M/R | A/D | I/B | N/D |
|---|---|---|---|---|---|---|---|
| | | | | Difference, t-ratio, and Significance Level* | | | |
| Language Disorder | 63 | 101.571 | 10.518 | 2.554<br>0.629<br>.60>.50 | 0.762<br>0.361<br>.80>.70 | 2.442<br>1.030<br>.40>.30 | 12.104<br>3.897<br>.01>.001 |
| Hearing Loss | 8 | 104.125 | 17.920 | -- | 1.792<br>0.432<br>.70>.60 | 4.996<br>1.165<br>.30>.20 | 14.658<br>3.096<br>.01>.001 |
| Articulation Disorder | 45 | 102.333 | 9.350 | | -- | X | X |
| Immature Behavior | 31 | 99.129 | 11.653 | | | -- | X |
| Not Differentiated | 15 | 89.467 | 6.692 | | | | -- |
| F-ratio and Significance Level | | 4.721<br><.01 | | | | | |

*In each cell, the top number is the difference; the middle, the t-ratio; the bottom, the significance level.

### Table 52

### Comparison of the Combined Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

### ("Pure" Diagnoses Only)

| Diagnostic Categories of the $\overline{503}$ Group | Number | Prenatal History Items | | Birth Presentation History Items | | Neonatal History Items | | Delivery History Items | | Postnatal History Items* | | Possible Organic History Items* | | High Temperature Diseases History Items* | | Surgery History Items* | | Medical Diagnoses | | Possible Psychoneurotic Behavior Problems* | | Possible Psychomotor Behavior Problems* | | Possible Organic Behavior Problems* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorder | 1 | 35 | 52.2 | 7 | 10.5 | 11 | 16.4 | 61 | 91.0 | 8 | 11.9 | 14 | 20.9 | 16 | 23.9 | 17 | 25.4 | 65 | 97.0 | 21 | 31.3 | 2 | 3.0 | 46 | 68.7 |
| Mental Retardation | 2 | 34 | 46.0 | 7 | 9.5 | 25 | 33.8 | 67 | 90.5 | 5 | 6.8 | 19 | 25.7 | 19 | 25.7 | 18 | 24.3 | 72 | 97.3 | 41 | 55.4 | 9 | 12.2 | 47 | 63.5 |
| Emotional Disturbance | 3 | 42 | 52.5 | 6 | 7.5 | 7 | 8.8 | 73 | 91.3 | 16 | 20.0 | 5 | 6.3 | 26 | 32.5 | 15 | 18.8 | 67 | 83.8 | 61 | 76.3 | 15 | [illegible] | 37 | 46.3 |
| Immature Behavior | 4 | 15 | 48.4 | 2 | 6.5 | 2 | 6.5 | 25 | 80.7 | 4 | 12.9 | 3 | 9.7 | 7 | 22.6 | 5 | 16.1 | 19 | 61.3 | 13 | 41.9 | 2 | 6.5 | 3 | 9.7 |
| Hearing Loss | 5 | 8 | 53.3 | 2 | 13.3 | 1 | 6.7 | 14 | 93.3 | 1 | 6.7 | 1 | 6.7 | 3 | 20.0 | 4 | 26.7 | 14 | 93.3 | 7 | 46.7 | 0 | --- | 5 | 33.3 |
| Articulation Disorder | 6 | 17 | 37.0 | 5 | 10.9 | 2 | 4.4 | 43 | 93.5 | 3 | 6.5 | 7 | 15.2 | 6 | 13.0 | 8 | 17.4 | 27 | 58.7 | 5 | 10.9 | 0 | --- | 8 | 17.4 |
| Not Differentiated | 7 | 13 | 46.4 | 5 | 17.9 | 5 | 17.9 | 24 | 85.7 | 1 | 3.6 | 4 | 14.3 | 4 | 14.3 | 4 | 14.3 | 24 | 85.7 | 13 | 46.4 | 1 | 3.6 | 6 | 21.4 |
| Chi-Square based on #'s: | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | | 1,2,3 | |
| Chi-Square Value & Significance Level | | 0.820<br>.70 > 50 | | 0.107<br>.95 > 90 | | =12.839<br><.01 | | 0.024<br>.98 > 95 | | 4.719<br>.10 > 05 | | 9.203<br>.02 > .01 | | 1.561<br>.50 > 30 | | 1.097<br>.70 > 50 | | 12.942<br><.01 | | 29.798<br><.01 | | 6.426<br>.05 > 02 | | 8.568<br>.02 > 01 | |
| Total N | | 164 | | 34 | | 53 | | 307 | | 38 | | 53 | | 81 | | 71 | | 288 | | 161 | | 29 | | 152 | |

* Indicates this information was reported by parents.

## Table 53

Comparison of the Combined Dichotomous Variables Among the Seven Diagnostic Categories of the Total $\overline{503}$ Group

("Mixed" Diagnoses Only)

| Diagnostic Category of the $\overline{503}$ Group | Number | Prenatal History Items | | Birth Presentation History Items | | Neonatal History Items | | Delivery History Items | | Postnatal History Items* | | Possible Organic History Items* | | High Temperature Diseases History Items* | | Surgery History Items* | | Medical Diagnoses | | Possible Psychoneurotic Behavior Problems* | | Possible Psychomotor Behavior Problems* | | Possible Organic Behavior Problems | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % | N | % |
| Language Disorders | 1 | 60 | 54.6 | 11 | 10.0 | 18 | 16.4 | 107 | 97.3 | 16 | 14.5 | 30 | 27.3 | 35 | 31.8 | 21 | 19.1 | 104 | 94.6 | 64 | 58.2 | 16 | 14.6 | 80 | 72.7 |
| Mental Retardation | 2 | 16 | 53.3 | 2 | 6.7 | 4 | 13.3 | 29 | 96.7 | 4 | 13.3 | 8 | 26.7 | 7 | 23.3 | 5 | 16.7 | 29 | 96.7 | 20 | 66.7 | 10 | 33.3 | 22 | 73.3 |
| Emotional Disturbance | 3 | 5 | 62.5 | 1 | 12.5 | 2 | 25.0 | 8 | 100.0 | 0 | ---- | 2 | 25.0 | 2 | 25.0 | 2 | 25.0 | 5 | 62.5 | 6 | 75.0 | 2 | 25.0 | 4 | 50.0 |
| Immature Behavior | 4 | 15 | 48.4 | 2 | 6.5 | 2 | 6.5 | 25 | 80.7 | 4 | 12.9 | 3 | 9.7 | 7 | 22.6 | 5 | 16.1 | 19 | 61.3 | 13 | 41.9 | 2 | 6.5 | 3 | 9.7 |
| Hearing Loss | 5 | 17 | 58.6 | 5 | 17.2 | 4 | 13.8 | 25 | 86.2 | 1 | 3.5 | 2 | 6.9 | 5 | 17.2 | 4 | 13.8 | 26 | 89.7 | 15 | 51.7 | 3 | 10.3 | 13 | 44.8 |
| Articulation Disorder | 6 | 17 | 37.0 | 5 | 10.9 | 2 | 4.4 | 43 | 93.5 | 3 | 6.5 | 7 | 15.2 | 6 | 13.0 | 8 | 17.4 | 27 | 58.7 | 5 | 10.9 | 0 | ---- | 8 | 17.4 |
| Not Differentiated | 7 | 13 | 46.4 | 5 | 17.9 | 5 | 17.9 | 24 | 85.7 | 1 | 3.6 | 4 | 14.3 | 4 | 14.3 | 4 | 14.3 | 24 | 85.7 | 13 | 46.4 | 1 | 3.6 | 6 | 21.4 |
| Chi-Square based on #'s: | | 1, 2 | | ---- | | ---- | | 1, 2, 3 | | ---- | | ---- | | 1, 2 | | 1, 2 | | 1, 2, 3 | | 1, 2 | | 1, 2 | | 1, 2, 3 | |
| Chi-Square Value and Significance Level | | 0.014<br>>.99 | | $x^2$ not computed | | $x^2$ not computed | | 0.001<br>>.99 | | $x^2$ not computed | | $x^2$ not computed | | 0.455<br>.80>.70 | | 0.001<br>.99 | | 0.573<br>.80>.70 | | 0.071<br>.99 | | 4.330<br>.05>.02 | | 0.295<br>.90>.80 | |
| Total N | | 143 | | 31 | | 37 | | 261 | | 29 | | 56 | | 66 | | 49 | | 234 | | 136 | | 34 | | 136 | |

* Indicates this Information was reported by parents.

## Table 54

### Comparison of the Tested I. Q. and the Estimated Potential I. Q. Within the Dignostic Categories of the Total 503 Group

| Groups | Mean Tested I. Q. | Mean Est. Potential I. Q. | Difference between Means | T-Test Value | Difference | Significance Level Prob. |
|---|---|---|---|---|---|---|
| Language Problems | 84 | 98 | 14 | 9.461 | 352 | <.01 |
| Mentally Retarded | 64 | 68 | 4 | 1.927 | 190 | .10>.05 |
| Emotionally Disturbed | 96 | 102 | 6 | 1.914 | 114 | .10>.05 |
| Hearing Loss | 95 | 105 | 10 | 1.697 | 41 | .10>.05 |
| Articulation Disorders | 102 | 102 | 0 | - | 88 | - |
| Immature Behavior | 96 | 99 | 3 | 1.398 | 60 | .20>.10 |
| Not Differentiated | 79 | 89 | 10 | 2.675 | 28 | .02>.01 |

## Table 55

### Comparison of the Tested I. Q. and the Estimated Potential I. Q. Within the Sub-Groups of the Diagnostic Categories of the Total $\overline{503}$ Group

| Diagnostic Category Sub-Groups of $\overline{503}$ Group | | Mean Tested I. Q. | Mean Estimated Potential I. Q. | Difference Between Means | T-Test Value | Difference | Probability |
|---|---|---|---|---|---|---|---|
| L/D: | Pure L/D | 90 | 101 | 11 | 4.892 | 132 | <.01 |
| | Total Mixed L/D | 81 | 96 | 15 | 8.607 | 218 | <.01 |
| | Total 2-Problem Mixed L/D | 81 | 97 | 16 | 7.520 | 180 | <.01 |
| | Total 3 & 4-Problem Mixed L/D | 77 | 94 | 17 | 4.388 | 36 | <.01 |
| | L/D + M/R | 71 | 89 | 18 | 10.204 | 64 | <.01 |
| | L/D + E/D | 87 | 101 | 14 | 4.717 | 90 | <.01 |
| | L/D + H/L | 91 | 103 | 12 | 2.772 | 22 | .02 > .01 |
| | Total Mixed L/D without M/R | 88 | 102 | 14 | 5.698 | 124 | <.01 |
| E/D: | Pure E/D | 99 | 103 | 4 | 1.579 | 100 | .20 > .10 |
| | Total Mixed E/D | 68 | 90 | 22 | 4.368 | 12 | <.01 |
| H/L: | Pure H/L | 102 | 111 | 9 | 1.144 | 19 | .30 > .20 |
| | Total Mixed H/L | 89 | 99 | 10 | 1.263 | 20 | .30 > .20 |
| | Total 2-Problem Mixed H/L | 90 | 100 | 10 | 1.172 | 18 | .30 > .20 |
| | H/L + E/D | 93 | 104 | 11 | 1.061 | 14 | .40 > .30 |

## Table 56

### Comparison of Age Walk, Age Words and Birth Weight Among the Sub-Groups of the Diagnostic Categories of the Total 503 Group

| Diagnostic Category Sub-groups of the 503 Group | Age Walk (in months) | | | | Age Words (in months) | | | | Age Sentences (in mos.) | | | | Birth Weight (in oz.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | * Diff. | T-Ratio | * Df | P | * Diff. | T-Ratio | * Df | P | * Diff. | T-Ratio | * Df | P | * Diff. | T-Ratio | * Df | P |
| L/D: "Pure" L/D vs. L/D M/R | 3.5 | 3.455 | 96 | <.01 | - | - | - | - | 5.3 | 1.811 | 64 | .10><br>.05 | - | - | - | - |
| "Pure" L/D vs. Total "Mixed" L/D | - | - | - | - | - | - | - | - | - | - | - | - | 17.5 | 2.398 | 79 | .05><br>.02 |
| E/D: "Pure" E/D vs. 2-Problem Mixed E/D | 2.6 | 1.294 | 83 | .10><br>.05 | - | - | - | - | - | - | - | - | - | - | - | - |
| "Pure" E/D vs. Total "Mixed E/D | - | - | - | - | - | - | - | - | - | - | - | - | 11.9 | 1.835 | 84 | .10><br>.05 |
| "Pure" E/D vs. E/D M/R | - | - | - | - | - | - | - | - | - | - | - | - | 7.1 | 1.451 | 83 | .20><br>.10 |
| M/R: "Pure" M/R vs. 2-problem "Mixed" M/R | 1.3 | 1.024 | 91 | .40><br>.30 | - | - | - | - | - | - | - | - | - | - | - | - |
| "Pure" M/R vs. Total "Mixed" M/R | 1.5 | 1.164 | 93 | .30><br>.20 | - | - | - | - | 4.1 | 0.969 | 37 | .40><br>.30 | - | - | - | - |
| H/L: "Pure" H/L vs. Total "Mixed" H/L | 3.0 | 1.574 | 25 | .20><br>.10 | 8.4 | 1.156 | 13 | .30><br>.20 | - | - | - | - | 6.4 | 0.655 | 26 | .60><br>.50 |
| L/D: L/D M/R vs. "Mixed" L/D without M/R | 3.0 | 2.868 | 90 | <.01 | - | - | - | - | 5.6 | 1.619 | 43 | .20><br>.10 | - | - | - | - |
| "Pure" L/D vs. "Mixed" L/D without M/R | 0.5 | 0.949 | 124 | .40><br>.30 | - | - | - | - | 0.3 | 0.112 | 77 | .90><br>.80 | 8.4 | 2.025 | 119 | .05><br>.01 |
| H/L: "Pure" H/L vs. "Mixed" H/L without M/R | - | - | - | - | 10.4 | 1.316 | 12 | .30><br>.20 | 12.8 | 1.638 | 6 | .20><br>.10 | 7.8 | 0.747 | 24 | .50><br>.40 |

* Diff. = The difference between the two means; df = The degrees of freedom.

## Table 57

### Pearson Product-Moment Correlations Between Age Walk, Age Words and Age Sentences vs. Both Tested and Estimated Potential I. Q. Scores for the Total 503 Group and for Sub-Groups as Indicated ("N" and "r" Respectively)

| Group and I. Q. Variables | Age Walk | Age Words | Age Sentences |
|---|---|---|---|
| Total 503 Group: Tested I. Q. | 425/-.381 | 349/-.249 | 254/-.510 |
| Estimated Potential I. Q. | 425/-.354 | 349/-.162 | 254/-.381 |
| Total Pure Diagnoses Only: | | | |
| Tested I. Q. | 278/-.449 | 244/-.293 | 191/-.280 |
| Estimated Potential I. Q. | 278/-.462 | 244/-.184 | 191/-.232 |
| Total Mixed Diagnoses Only: | | | |
| Tested I. Q. | 147/-.217 | 105/-.138 | 63/-.186 |
| Estimated Potential I. Q. | 147/-.100 | 105/-.108 | 63/-.171 |
| Total Dysarticulation: Tested I. Q. | 43/-.061 | 42/-.014 | 39/-.004 |
| Estimated Potential I. Q. | 43/-.074 | 42/-.018 | 39/-.021 |
| Total Immature: Tested I. Q. | 30/ .030 | 29/ .145 | 23/ .198 |
| Estimated Potential I. Q. | 30/ .162 | 29/ .336 | 23/ .286 |
| Total Not Differentiated: Tested I. Q. | 13/ .227 | 12/ .084 | 8/-.069 |
| Estimated Potential I. Q. | 13/-.470 | 12/-.130 | 8/-.275 |
| Total Language Disorder: Tested I. Q. | 172/-.232 | 137/-.139 | 99/-.196 |
| Estimated Potential I. Q. | 172/-.126 | 137/ .046 | 99/-.063 |
| Language Disorder (Pure Only) | | | |
| Sub-group: Tested I. Q. | 66/-.172 | 62/-.090 | 50/-.066 |
| Estimated Potential I. Q. | 66/ .018 | 62/ .150 | 50/-.031 |
| Language Disorder (Mixed Only) | | | |
| Sub-group: Tested I. Q. | 106/-.194 | 75/-.208 | 49/-.266 |
| Estimated Potential I. Q. | 106/-.131 | 75/-.046 | 49/-.066 |
| Mental Retardation: Tested I. Q. | 88/-.402 | 66/-.362 | 37/-.088 |
| Estimated Potential I. Q. | 88/-.310 | 66/-.173 | 37/-.498 |
| M/R Pure Only: Tested I. Q. | 65/-.465 | 49/-.380 | 30/-.600 |
| Estimated Potential I. Q. | 65/-.411 | 49/-.131 | 30/-.509 |
| M/R Mixed Only: Tested I. Q. | 23/-.143 | 17/-.265 | 7/-.128 |
| Estimated Potential I. Q. | 23/-.114 | 17/-.271 | 7/-.480 |
| E/D Total: Tested I. Q. | 58/-.201 | 51/ .081 | 40/-.001 |
| Estimated Potential I. Q. | 58/-.105 | 51/ .033 | 40/-.014 |
| E/D Pure Only: Tested I. Q. | 51/-.046 | 47/ .076 | 38/-.003 |
| Estimated Potential I. Q. | 51/-.035 | 47/ .025 | 38/-.019 |
| E/D Mixed Only: Tested I. Q. | 7/-.623 | 4/ - | 2/ - |
| Estimated Potential I. Q. | 7/-.361 | 4/ - | 2/ - |
| Hearing Loss Total Group: Tested I. Q. | 21/-.354 | 12/-.169 | 8/ .057 |
| Estimated Potential I. Q. | 22/-.863 | 12/-.498 | 8/-.404 |
| H/L Pure Only: Tested I. Q. | 10/-.220 | 3/ - | 3/ - |
| Estimated Potential I. Q. | 11/ .102 | 3/ - | 3/ - |
| H/L Mixed Only: Tested I. Q. | 11/-.376 | 9/-.110 | 5/ .293 |
| Estimated Potential I. Q. | 11/-.344 | 9/-.480 | 5/-.322 |

## Table 58

### Continuous Variables in the Total T-50 Group

| Variables | N | Mean | S.D. | S.E. | Comments |
|---|---|---|---|---|---|
| Birth Weight (in ounces) | 50 | 114.440 | 23.856 | 3.408 | |
| Child's Age (in months) | 50 | 61.600 | 14.465 | 2.066 | |
| Walked Alone (in months) | 50 | 14.120 | 3.659 | 0.523 | |
| Talked Words (in months) | 45 | 27.600 | 9.992 | 1.506 | 5 (10%) not yet performing |
| Talked Sentences (in months) | 24 | 42.667 | 11.985 | 2.499 | 26 (52%) not yet performing |
| Hiskey I.Q. | 36 | 82.500 | 15.659 | 2.647 | 14 (28%) not able to be tested |
| Ammons I.Q. | 21 | 74.619 | 8.127 | 1.817 | 29 (58%) not able to be tested |
| CMMS I.Q. | 29 | 82.759 | 15.280 | 2.887 | 21 (42%) not able to be tested |
| Draw a Person I. Q. | 13 | 89.923 | 15.593 | 4.501 | 37 (74%) not able to be tested |
| Form Board Performance Quotient | 48 | 86.604 | 17.325 | 2.527 | 2 (4%) not able to be tested |
| Geometric Design Performance Quotient | 46 | 88.304 | 17.098 | 2.549 | 4 (8%) not able to be tested |
| Vineland S.Q. | 50 | 86.560 | 18.088 | 2.584 | |
| Father's I.Q. | 45 | 96.244 | 17.512 | 2.640 | 5 (10%) Unknown |
| Mother's I.Q. | 48 | 93.250 | 19.475 | 2.841 | 2 (4%) Unable to be tested |

## Table 59

### Single Dichotomous Variables in the Total T-50 Group

### (Race, Sex and Socio-Economic Status)

| Variables | N | % |
|---|---|---|
| Race | | |
| Negro | 7 | 14 |
| White | 43 | 86 |
| Sex | | |
| Male | 39 | 78 |
| Female | 11 | 22 |
| Socio-Economic Status | | |
| Professional | | |
| $10,000. and up | 11 | 22 |
| White Collar | | |
| $7,500 to $10,000 | 5 | 10 |
| Skilled | | |
| $5,000 to $7,500 | 15 | 30 |
| Semi-Skilled | | |
| $3,000 to $5,000 | 11 | 22 |
| Laborer | | |
| $1,000 to $3,000 | 4 | 8 |
| Unemployed | | |
| --- | 4 | 8 |
| Unknown | | |
| --- | 0 | -- |

## Table 60

## Single Dichotomous Variables in the Total T-50 Group

## (Prenatal History Items)

| Prenatal History Items | N | % |
|---|---|---|
| Miscarriage | 11 | 22 |
| Rh Incompatibility | 6 | 12 |
| Nausea | 4 | 8 |
| Hemorrhage | 8 | 16 |
| Toxemia | 0 | - |
| Emotional Tension | 5 | 10 |
| Familial Problem | 3 | 6 |
| Accidents | 1 | 2 |
| Other Problems | 0 | - |
| No Problems | 25 | 50 |

## Table 61

## Single Dichotomous Variables in the Total T-50 Group

## (Birth and Neonatal History Items)

| Birth History Items | N | % |
|---|---|---|
| Cephalic Presentation | 43 | 86 |
| Breech Presentation | 4 | 8 |
| Caesarian Section | 3 | 6 |
| Instruments Used | 2 | 4 |
| Cord Prolapse | 0 | - |
| Anesthesia Used | 27 | 54 |
| Other Delivery Problems | 7 | 14 |
| Precipitate Labor | 6 | 12 |
| Prolonged Labor | 1 | 2 |
| Induced Labor | 4 | 8 |
| Anoxia | 10 | 20 |
| Kernicterus | 4 | 8 |
| Anomalies | 4 | 8 |
| Convulsions | 1 | 2 |
| Cyanosis | 3 | 6 |
| Prematurity | 3 | 6 |
| Postmaturity | 3 | 6 |

## Table 62

### Single Dichotomous Variables in the Total T-50 Group

### (Postnatal History Items)

| Postnatal History Items | N | % |
|---|---|---|
| Colic | 4 | 8 |
| Eczema | 2 | 4 |
| Asthma | 1 | 2 |
| Orthopedic Problem | 3 | 6 |
| Strabismus | 8 | 16 |
| Febrile Episodes | 15 | 30 |
| Meningitis | 0 | - |
| Encephalitis | 0 | - |
| Surgery | 5 | 10 |
| Convulsions Present | 7 | 14 |
| Diseases: All types | 6 | 12 |
| Other Problems | 5 | 10 |
| No Problems | 30 | 60 |

Table 63

Single Dichotomous Variables in the Total T-50 Group

(Medical Diagnoses)

| Medical Problems | N | % |
|---|---|---|
| Organicity | 24 | 48 |
| Anomalies | 0 | - |
| Endocrine Disorders | 0 | - |
| Undifferentiated Problems | 20 | 40 |
| No Apparent Problem | 6 | 12 |

## Table 64

## Single Dichotomous Variables in the Total T-50 Group

## (Behavior Problems Reported by Parents)

| Behavior Problem History Items | N | % |
|---|---|---|
| Eneuresis (night) | 6 | 12 |
| Eneuresis (day) | 4 | 8 |
| Feeding Problems | 6 | 12 |
| Sleeping Problems | 3 | 6 |
| Destructiveness | 3 | 6 |
| Head Banging | 10 | 20 |
| Body Rocking | 8 | 16 |
| Behavior Change following Illness | 2 | 4 |
| Temper Tantrums | 7 | 14 |
| Hyperactivity | 9 | 18 |
| Negativism | 12 | 24 |
| Sibling Rivalry | 6 | 12 |
| Motor Problems (Gross) | 14 | 28 |
| Motor Problems (Five) | 18 | 36 |
| Perseveration | 4 | 8 |
| Immaturity | 9 | 18 |
| Lack of Group Play | 5 | 10 |

## Table 65

### Single Dichotomous Variables in the Total T-50 Group

### (Behavior Problems Reported by Examiners)

| Behavior Problem Test Items | N | % |
|---|---|---|
| Short Attention Span | 24 | 48 |
| Hyperactivity | 18 | 36 |
| Separation Problem | 7 | 14 |
| Perseveration | 4 | 8 |
| Lack of Contact | 6 | 12 |
| Poor Emotional Tone | 5 | 10 |
| No Localization of Sound | 13 | 26 |
| Asteriognosis | 6 | 12 |
| Drooling | 3 | 6 |
| Tremors | 17 | 34 |
| Visual-Motor Problem | 30 | 60 |
| Destructiveness | 1 | 2 |
| Aggressiveness | 1 | 2 |
| Comprehension Problem | 38 | 76 |
| Educational Problem | 11 | 22 |
| Distractability | 13 | 26 |
| Random Speech | 9 | 18 |
| Clumsiness | 31 | 62 |
| Refusal to Cooperate | 13 | 26 |
| No Problem | 7 | 14 |

## Table 66

### Single Dichotomous Variables in the Total T-50 Group

### (Speech Classifications)

| Speech Levels | N | % |
|---|---|---|
| No Speech | 7 | 14 |
| Delayed Speech | 30 | 60 |
| (Single Words) | (17) | (34) |
| (Phrases) | ( 7) | (14) |
| (Sentences) | ( 6) | (12) |
| Jargon | 5 | 10 |
| Echolalia | 3 | 6 |
| Articulation Disorder | 5 | 10 |
| (Omissions) | 1 | 2 |
| (Substitutions) | 3 | 6 |
| (Distortions) | 1 | 2 |
| No Speech Problems | 0 | - |

## Table 67

## Single Dichotomous Variables in the Total T-50 Group

### (Objective Test Items)

| Test Items | N | % |
|---|---|---|
| Form Board Passed | 7 | 14 |
| Geometric Design Passed | 41 | 82 |
| Picture Identification by: | | |
| Pointing | 6 | 12 |
| Gesturing | 3 | 6 |
| Naming | 11 | 22 |
| Unable to Identify | 30 | 60 |

## Table 68

## Combined Dichotomous Variables in the Total T-50 Group

| Combined Variables | N | % |
|---|---|---|
| Prenatal Problems | 25 | 50 |
| Birth Presentation Problems | 7 | 14 |
| Neonatal Problems | 9 | 18 |
| Delivery Problems | 38 | 76 |
| History Items: (Reported by Parents) | | |
| Postnatal Problems | 5 | 10 |
| Possible Organic Problems | 17 | 34 |
| High Temperature Diseases | 13 | 26 |
| Surgery | 5 | 10 |
| Medical Problems | 44 | 88 |
| Behavior Problems: (Reported by Parents) | | |
| Possible Psychoneurotic Behavior | 31 | 62 |
| Possible Psychomotor Disturbance | 11 | 22 |
| Possible Organic Behavior | 35 | 70 |

## Table 69

### Comparison of the Continuous and Combined Dichotomous Variables between the Total T-50 Group and the N/D Diagnostic Category of the Total $\overline{503}$ Group

| Variables | T-50 Group | | | Undifferentiated Category of $\overline{503}$ Group | | |
|---|---|---|---|---|---|---|
| Continuous: | N | Mean | S. D. | N | Mean | S. D. |
| Walked Alone (in months) | 50 | 14 | 3.7 | 26 | 14 | 4.0 |
| Talked Words (in months) | 45 | 28 | 10.0 | 22 | 30 | 10.6 |
| Talked Sentences (in months) | 24 | 43 | 12.0 | 15 | 38 | 11.3 |
| Birth Weight (in ounces) | 50 | 114 | 23.9 | 26 | 117 | 22.4 |
| Intelligence Quotient | 36 | 83* | 15.7 | 15 | 79* | 12.3 |
| Dichotomous: (Combined) | N | % | | N | % | |
| Prenatal Problems | 25 | 50 | | 13 | 46 | |
| Presentation Problems | 7 | 14 | | 5 | 18 | |
| Conditions Present at Birth | 9 | 18 | | 5 | 18 | |
| Birth Problems | 38 | 76 | | 24 | 86 | |
| Behavior History Problems: | | | | | | |
| Postnatal Problems | 5 | 10 | | 1 | 4 | |
| Possible Organic Problems | 17 | 34 | | 4 | 14 | |
| Diseases with Temperature | 13 | 26 | | 4 | 14 | |
| Surgery | 5 | 10 | | 4 | 14 | |
| Medical History Problems | 44 | 88 | | 24 | 86 | |
| Reported Behavior Problems: | | | | | | |
| Possible Psychoneurotic | 31 | 62 | | 13 | 46 | |
| Possible Psychomotor | 11 | 22 | | 1 | 4 | |
| Possible Organic | 35 | 70 | | 6 | 21 | |

*Two tests used--Hiskey for T-50 Group; Merrill-Palmer for $\overline{503}$ Group

## Table 70

### Diagnostic Categories of the Total T-50 Group

| Category | N | % |
|---|---|---|
| "Pure" Language Disorder | | |
| "Pure" (L/D) | 22 | 44 |
| "Mixed" Language Disorder with Mental Retardation | | |
| "Mixed" (L/D + M/R) | 23 | 46 |
| "Pure" Mental Retardation | | |
| "Pure" (M/R) | 5 | 10 |

## Table 71

### Continuous Variables in the "Pure" M/R Diagnostic Category of the T-50 Group (Total N = 5)

| Variables | N | Mean | Comments |
|---|---|---|---|
| Birth Weight in Ounces | 5 | 115.600 | |
| Child's Age in Months | 5 | 57.000 | |
| Walked Alone in Months | 5 | 13.800 | |
| Talked Words in Months | 4 | 27.500 | 1 not yet performing |
| Talked Sentences in Months | 2 | 36.000 | 3 not yet performing |
| Hiskey I. Q. | 2 | 69.500 | 3 not able to be tested |
| Ammons I. Q. | 2 | 62.500 | 3 not able to be tested |
| CMMS I. Q. | 2 | 65.000 | 3 not able to be tested |
| Draw a Person I. Q. | 0 | --- | 5 not able to be tested |
| Form Board Performance Quotient | 3 | 68.333 | 2 not able to be tested |
| Geometric Design Performance Quotient | 3 | 71.333 | 2 not able to be tested |
| Vineland S. Q. | 5 | 69.200 | |
| Father's I. Q. | 4 | 83.250 | 1 Unknown |
| Mother's I. Q. | 5 | 85.800 | |

## Table 72

### Comparison of the Continuous and Combined Dichotomous Variables between the "Pure" (L/D) Sub-Group of the Total T-50 Group and the "Pure" (L/D) Sub-Group of the Total $\overline{503}$ Group

| Variables | Sub-Group "Pure" (L/D) T-50 | | | Sub-Group "Pure" (L/D) 503 | | |
|---|---|---|---|---|---|---|
| **Continuous:** | N | Mean | S. D. | N | Mean | S. D. |
| Walked Alone (in months) | 22 | 13 | 2.3 | 66 | 13 | 2.8 |
| Talked Words (in months) | 20 | 30 | 10.1 | 62 | 28 | 11.5 |
| Talked Sentences (in months) | 14 | 46 | 13.2 | 50 | 38 | 10.5 |
| Birth Weight (in ounces) | 22 | 116 | 23.3 | 62 | 116 | 19.9 |
| Intelligence Quotient | 17 | 91* | 14.4 | 67* | 90 | 14.7 |
| **Dichotomous (Combined)** | N | % | | N | % | |
| Prenatal Problems | 12 | 55 | | 35 | 52 | |
| Presentation Problems | 5 | 23 | | 7 | 10 | |
| Conditions Present at Birth | 6 | 27 | | 11 | 16 | |
| Birth Problems | 18 | 82 | | 61 | 91 | |
| Behavior History Problems: | | | | | | |
| Postnatal Problems | 1 | 4 | | 8 | 12 | |
| Possible Organic Problems | 7 | 32 | | 14 | 21 | |
| Diseases With Temperature | 9 | 41 | | 16 | 24 | |
| Surgery | 2 | 9 | | 17 | 25 | |
| Medical History Problems | 18 | 82 | | 65 | 97 | |
| Reported Behavior Problems: | | | | | | |
| Possible Psychoneurotic | 14 | 64 | | 21 | 31 | |
| Possible Psychomotor | 2 | 9 | | 2 | 3 | |
| Possible Organic | 16 | 73 | | 46 | 69 | |

*Two different Tests used here (Hiskey for T-50; Merrill-Palmer for $\overline{503}$)

## Table 73

### Comparison of the Continuous and Combined Dichotomous Variables between the "Mixed" L/D ≠ M/R Sub-Group of the Total T-50 Group and the "Mixed" L/D ≠ M/R Sub-Group of the Total $\overline{503}$ Group

| Variables | Sub-Group "mixed" (L/D ≠ M/R) T-50 Group | | | Sub-Group "mixed" (L/D ≠ M/R) Total $\overline{503}$ Group | | |
|---|---|---|---|---|---|---|
| Continuous: | N | Mean | S. D. | N | Mean | S. D. |
| Walked Alone (in months) | 23 | 16 | 4.3 | 32 | 17 | 5.3 |
| Talked Words (in months) | 21 | 26 | 10.1 | 28 | 28 | 9.4 |
| Talked Sentences (in months) | 8 | 39 | 9.1 | 16 | 44 | 9.8 |
| Birth Weight (in ounces) | 23 | 112 | 22.3 | 31 | 108 | 24.8 |
| Intelligence Quotient | 17* | 76 | 12.9 | 33* | 71 | 9.0 |
| Dichotomous: (Combined) | N | % | ___ | N | % | ___ |
| Prenatal Problems | 10 | 43 | | 16 | 49 | |
| Presentation Problems | 2 | 9 | | 5 | 15 | |
| Conditions Present at Birth | 3 | 13 | | 11 | 33 | |
| Birth Problems | 16 | 70 | | 33 | 100 | |
| Behavior History Problems: | | | | | | |
| Postnatal Problems | 4 | 17 | | 6 | 18 | |
| Possible Organic Problems | 9 | 39 | | 10 | 30 | |
| Diseases with Temperature | 4 | 17 | | 8 | 24 | |
| Surgery | 3 | 13 | | 3 | 9 | |
| Medical History Problems | 21 | 91 | | 32 | 97 | |
| Reported Behavior Problems: | | | | | | |
| Possible Psychoneurotic | 13 | 56 | | 14 | 42 | |
| Possible Psychomotor | 9 | 39 | | 0 | -- | |
| Possible Organic | 16 | 70 | | 26 | 79 | |

*Two different Tests used here (Hiskey for T-50; Merrill-Palmer for $\overline{503}$).

### Table 74

Comparison of the Continuous Variables Between the "Pure" (L/D) and the "Mixed" (L/D + M/R) Sub-groups of the T-50 Group

| Continued Variables | "Pure" (L/D) Total N = 22 | | | | | "Mixed" (L/D + M/R) Total N = 23 | | | | | Difference Means | t-ratio | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | S.D. | U* | NP* | N | Mean | S.D | U* | NP* | | | |
| Birth Weight (in Ounces) | 22 | 116.409 | 23.308 | -- | -- | 23 | 112.304 | 22.317 | -- | -- | 4.105 | 0.589 | .60>.50 |
| Child's Age (in Months) | 22 | 63/545 | 14.506 | -- | -- | 23 | 60.739 | 14.537 | -- | -- | 2.806 | 0.633 | .60>.50 |
| Walked Alone (in Months) | 22 | 12.591 | 2.270 | -- | -- | 23 | 15.652 | 4.290 | -- | -- | 3.061 | 2.943 | <.01 |
| Talked Words (in Months) | 20 | 29.750 | 10.084 | -- | 2 | 21 | 25.571 | 10.079 | -- | 2 | 4.179 | 1.294 | .30>.20 |
| Talked Sentences (in Months) | 14 | 45.857 | 13.174 | -- | 8 | 8 | 38.750 | 9.107 | -- | 15 | 7.107 | 1.416 | .20>.10 |
| Hiskey I. Q. | 17 | 90.765 | 14.424 | -- | 5 | 17 | 75.765 | 12.923 | -- | 6 | 15.000 | 3.098 | <.01 |
| Ammons I. Q. | 11 | 74.636 | 4.848 | -- | 11 | 8 | 77.625 | 9.682 | -- | 15 | 2.989 | 0.753 | .50>.40 |
| CMMS I. Q. | 18 | 88.111 | 15.184 | -- | 4 | 9 | 76.000 | 10.614 | -- | 14 | 12.111 | 2.303 | .05>.02 |
| Draw A Person I. Q. | 9 | 91.000 | 17.166 | -- | 13 | 4 | 87.500 | 10.897 | -- | 19 | 3.500 | 0.400 | .70>.60 |
| Form Board Performance Quotient | 22 | 95.227 | 16.608 | -- | -- | 23 | 80.739 | 14.134 | -- | -- | 14.488 | 3.073 | <.01 |
| Geometry Design Performance Quotient | 21 | 98.429 | 14.470 | -- | 1 | 22 | 80.955 | 14.640 | -- | 1 | 17.474 | 3.843 | <.01 |
| Vineland S. Q. | 22 | 96.182 | 17.390 | -- | -- | 23 | 81.130 | 13.870 | -- | -- | 15.052 | 3.129 | <.01 |
| Father's I. Q. | 21 | 96.238 | 14.219 | 1 | -- | 20 | 98.850 | 20.478 | 3 | -- | 2.612 | 0.460 | .70>.60 |
| Mother's I. Q. | 20 | 89.200 | 14.811 | 2 | -- | 23 | 98.391 | 23.085 | -- | -- | 9.191 | 1.537 | .20>.10 |

* U = Information Unknown

* NP = Not Yet Performing

## Table 75

### Comparison of the Combined Dichotomous Variables between the "Pure" (L/D) and the "mixed" (L/D ≠ M/R) Sub-Groups of the T-50 Group

| Combined Dichotomous Variables | "Pure" (L/D) Total N= 22 | | "Mixed" (L/D ≠ M/R) Total N= 23 | |
|---|---|---|---|---|
| | N | % | N | % |
| Prenatal Problems | 12 | 55 | 10 | 43 |
| Presentation Problems | 5 | 23 | 2 | 9 |
| Conditions Present at Birth | 6 | 27 | 3 | 13 |
| Birth Problems | 18 | 82 | 16 | 70 |
| Behavior History Problems: | | | | |
| Postnatal Problems | 1 | 4 | 4 | 17 |
| Possible Organic Problems | 7 | 32 | 9 | 39 |
| Diseases with Temperature | 9 | 41 | 4 | 17 |
| Surgery | 2 | 9 | 3 | 13 |
| Medical History Problems | 18 | 82 | 21 | 91 |
| Reported Behavior Problems: | | | | |
| Possible Psychoneurotic | 14 | 64 | 13 | 56 |
| Possible Psychomotor | 2 | 9 | 9 | 39 |
| Possible Organic | 16 | 73 | 16 | 70 |

## Table 76

### Comparison of the Dichotomous Variables in the "Pure" (L/D) vs. "mixed" (L/D + M/R) Diagnostic Categories of the T-50 Group (Behavior as Reported by Examiner)

| Dichotomous Variables | "Pure" Languge (N = 22) |  | "Mixed" Language (N= 23) |  | Chi-Square | Probability |
|---|---|---|---|---|---|---|
|  | N | % | N | % |  |  |
| Short Attention Span | 6 | 27.3 | 13 | 56.7 | 2,813 | .10>.05 |
| Lateral Movement of Tongue | 4 | 18,2 | 12 | 52,2 | 4,255 | .05>.02 |
| Visual Motor Problem | 10 | 45.5 | 20 | 87.0 | 6.911 | <.01 |

## Table 77

## Comparison of the Dichotomous Variables in the "Pure" (L/D) vs. "mixed" (L/D & M/R) Diagnostic Categories of the T-50 Group (Objective Test Items)

| Dichotomous Variables | "Pure" Language (N = 22) |  | "Mixed" Language (N = 23) |  | Chi-Square | Probability |
|---|---|---|---|---|---|---|
|  | N | % | N | % |  |  |
| Form Board | 6 | 27.3 | 14 | 60.9 | 3.843 | .05>.02 |
| Geometric Design | 6 | 27.3 | 15 | 65.2 | 6.505 | .02>.01 |
| D.A.P. | 8 | 36.4 | 15 | 65.2 | 3.746 | .10>.05 |

### Table 78

### Comparison of the Dichotomous Variables in the "Pure" (L/D) vs. "mixed" (L/D + M/R) Diagnostic Categories of the T-50 Group (Judgment of Relationships)

| Dichotomous Variables | "Pure" Language (N = 22) |  | "Mixed" Language (N = 23) |  | Chi-Square | Prob-ability |
|---|---|---|---|---|---|---|
|  | N | % | N | % |  |  |
| Size Problem | 9 | 40.9 | 19 | 82.6 | 6.603 | .02>.01 |
| Direction Problem | 12 | 54.5 | 19 | 82.6 | 2.902 | .10>.05 |
| Weight Problem | 8 | 36.4 | 15 | 62.2 | 3.746 | .10>.05 |
| Volume Problem | 8 | 36.4 | 15 | 62.2 | 3.746 | .10>.05 |
| Speed Problem | 11 | 50.0 | 21 | 91.3 | 7.396 | <.01 |

## Table 79

### Comparison of the Dichotomous Variables in the "Pure" (L/D) vs. "mixed" (L/D ≠ M/R) Diagnostic Categories of the T-50 Group (Observations During Psychologic Testing)

| Dichotomous Variables | "Pure" Language (N = 22) |  | "Mixed" Language (N = 23) |  | Chi-Square | Probability |
|---|---|---|---|---|---|---|
|  | N | % | N | % |  |  |
| Affect Problem | 5 | 22.7 | 14 | 69.9 | 5.203 | .05 > .02 |
| Trial and Error Problem | 7 | 31.8 | 16 | 69.6 | 6.412 | .02 > .01 |
| Deliberation Problem | 13 | 59.1 | 21 | 91.3 | 4.661 | .05 > .02 |
| Awareness Success Problem | 6 | 27.3 | 13 | 56.5 | 2.813 | .10 > .05 |
| Finger-Hand Coordination Problem | 8 | 36.4 | 16 | 69.6 | 4.980 | .05 > .02 |
| Imitation of Gesture Problem | 3 | 13.6 | 10 | 43.5 | 3.503 | .10 > .05 |

## Table 80

### Comparison of the Dichotomous Variables in the "Pure" (L/D) vs. "mixed" (L/D + M/R) Diagnostic Categories of the T-50 Group (Observations During Therapy)

| Dichotomous Variables | "Pure" Language (N = 22) N | "Pure" Language (N = 22) % | "Mixed" Language (N = 23) N | "Mixed" Language (N = 23) % | Chi-Square | Probability |
|---|---|---|---|---|---|---|
| Receptive Language Problem | 12 | 54.5 | 19 | 82.6 | 2.902 | .10>.05 |
| Behavior Problem | 7 | 31.8 | 14 | 60.9 | 3.813 | .10>.05 |
| Figure-Ground Disturbance | 2 | 9.1 | 10 | 43.5 | 5.121 | .05>.02 |
| Visual-Motor Problem | 1 | 4.5 | 17 | 73.9 | 19.687 | <.01 |
| Imitation Problem | 5 | 22.7 | 12 | 52.2 | 2.966 | .10>.05 |
| Drawing Problem | 13 | 59.1 | 20 | 87.0 | 3.127 | .10>.05 |
| Educational Potential Problem | 9 | 41.0 | 21 | 91.3 | 10.637 | <.01 |

## Table 81

### Comparison of Various I.Q. Scores
### Before and After Therapy in the
### Total T-50 Group

| Test Used | Initial | | | Final | | | Diff. | T ratio | P |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | S.D. | N | Mean | S.D. | | | |
| Hiskey I.Q. | 34 | 83.265 | 15.614 | 34 | 96.500 | 16.534 | 13.235 | 6.498 | <.01 |
| Ammons I. Q. | 19 | 75.895 | 7.433 | 19 | 86.316 | 12.674 | 10.421 | 4.067 | <.01 |
| CMMS I. Q. | 27 | 84.074 | 14.961 | 27 | 97.963 | 16.798 | 13.889 | 5.458 | <.01 |
| DAP I. Q. | 13 | 89.923 | 15.593 | 13 | 97.231 | 13.560 | 7.308 | 2.857 | .02>.0 |

## Table 82

### Comparison of Various I. Q. Scores Before and After Therapy in the "Pure" L/D Diagnostic Category of the T-50 Group

| Test Used | Initial | | | Final | | | Diff. | T test | P |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | S. D. | N | Mean | S. D. | | | |
| Hiskey I. Q. | 17 | 90.765 | 14.424 | 17 | 104.471 | 16.418 | 13.706 | 3.970 | <.01 |
| Ammons I. Q. | 11 | 74.636 | 4.848 | 11 | 87.636 | 14.067 | 13.000 | 3.355 | <.01 |
| CMMS I. Q. | 18 | 88.111 | 15.184 | 18 | 102.611 | 14.656 | 14.500 | 4.434 | <.01 |
| DAP I. Q. | 9 | 91.000 | 17.166 | 9 | 94.667 | 14.952 | 3.667 | 3.667 | <.01 |

### Table 83

### Comparison of Various I. Q. Scores Before and After Therapy in the "Mixed" (L/D + M/R) Diagnostic Category of the T-50 Group

| Test Used | Initial |  |  | Final |  |  | Diff- | t - | P |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  | N | Mean | S.D. | N | Mean | S.D. | erence | ratio |  |  |
| Hiskey I. Q. | 17 | 75.765 | 12.923 | 17 | 88.529 | 12.253 | 12.764 | 6.049 |  | .01 |
| Ammons I. Q. | 8 | 77.625 | 9.682 | 8 | 84.500 | 10.186 | 6.875 | 2.650 | .05 | .02 |
| CMMS I. Q. | 9 | 76.000 | 10.614 | 9 | 88.667 | 16.951 | 12.667 | 2.877 | .05 | .02 |
| D. A. P. I. Q. | 4 | 87.500 | 9.683 | 4 | 103.000 | 6.819 | 15.500 | 2.267 | .20 | .10 |

## Table 84

## Comparison of Various I. Q. Scores Before and After Therapy in the "Pure" (M/R) Diagnostic Category of the T-50 Group (For Inspection Only)

| Test Used | Initial | | | Final | | | Difference | t - test | P |
|---|---|---|---|---|---|---|---|---|---|
| | N | Mean | S.D. | N | Mean | S/D | | | |
| Hiskey I. Q. | 2 | 69.500 | ---- | 2 | 71.000 | ---- | 1.500 | --- | --- |
| Ammons I. Q. | 2 | 62.500 | ---- | 2 | 64.500 | ---- | 2.000 | --- | --- |
| CMMS I. Q. | 2 | 65.000 | ---- | 2 | 70.500 | ---- | 5.500 | --- | --- |
| D.A.P. I. Q. | 0 | ----- | ---- | 0 | ---- | ---- | ----- | --- | --- |

## Table 85

**Comparison of the "Pure" L/D sub-group
with the "Mixed" L/D + M/R Sub-
group of the Total T-50 Group on
the Sub-Test Items of the Hiskey**

| Eleven Sub-tests of the Hiskey | Require-ments for Sub-test | Means for L/D Sub-group | Means for L/D + M/R Sub-group | Diff. | Means for Total T-50 Group |
|---|---|---|---|---|---|
| Memory for Colored Objects | Matching | 101 | 95 | 6 | 99 |
| Bead Stringing | Speed<br>Copying<br>Retention | 90 | 92 | -2 | 91 |
| Pictorial Association | Association | 110 | 97 | 13 | 105 |
| Block Patterns | Copying | 100 | 91 | 9 | 96 |
| Memory for Digits | Auditory Retention | 101 | 75 | 26 | 90 |
| Completion of Drawings | Visual-Motor Closure | 137 | 77 | 60 | 112 |
| Pictorial Identification | Matching | 119 | 101 | 18 | 112 |
| Paper Folding | Visual-Motor Retention | 81 | 69 | 12 | 76 |
| Visual Attention Span | Visual Retention | 104 | 91 | 13 | 98 |
| Puzzle Blocks | Copying | 106 | 89 | 17 | 99 |
| Picture Analysis | Sequential Organization | 111 | 91 | 20 | 103 |
| F-Ration and Probability | | 2.601<br><.01 | 1.232<br>>.05 | --- | 2.317<br><.05 |

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